

DEPARTMENT OF THE NAVY

SOUTHWEST DIVISION NAVAL FACILITIES ENGINEERING COMMAND 1220 PACIFIC HIGHWAY SAN DIEGO, CA 92132-5190

> 5090 Ser 5CEN.MB/622 October 2, 2003

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Dear Ms. Griffey, Mr. Mahmoud, and Mr. Hausladen:

The Department of the Navy forwarded the document "Draft Final Remedial Action Site Closure Report" for Installation Restoration Site 2A, at Marine Corps Base, Camp Pendleton, to the Federal Facilities Agreement (FFA) team members over 30 days ago. No additional comments were received during this time period. Per FFA section 7.9, Finalization of Documents, the Draft Final primary document is now Final.

Please place a copy of this letter in the front cover of the document. Should you have any questions, please call the Department of the Navy Remedial Project Manager, Mr. Mike Bilodeau, at (619) 532-3829.

Sincerely,

KATHIE BEVERLY

Environmental Business Line

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Team Leader

By direction of the Commander

5090 Ser 5CEN.MB/622 October 2, 2003

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DRAFT FINAL REMEDIAL ACTION SITE CLOSURE REPORT OPERABLE UNIT 3, INSTALLATION RESTORATION SITE 2A 14 AREA GREASE DISPOSAL PIT MARINE CORPS BASE CAMP PENDLETON, CALIFORNIA

Environmental Remedial Action Contract No. N62474-98-D-2076 Contract Task Order 0080

Document Control Number 6469 Revision 0

August 6, 2003

Submitted to:

U.S. Department of the Navy Southwest Division Naval Facilities Engineering Command 1220 Pacific Highway San Diego, California 92132-5190

Submitted by:

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August 6, 2003

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Abbreviations and Acronyms

ARAR applicable or relevant and appropriate requirements

ASTM American Society for Testing and Materials
Cal/EPA California Environmental Protection Agency
CalTrans California Department of Transportation

CAMU corrective action management unit

CERCLA Comprehensive Environmental Response, Compensation, and

Liability Act

CFR Code of Federal Regulations

COCs chemicals of concern

COECs chemicals of ecological concern COPCs chemicals of potential concern

COPECs chemicals of potential ecological concern

CTO Contract Task Order

4,4'-DDD4,4'-dichlorodiphenyldichloroethane4,4'-DDE4,4'-dichlorodiphenyldichloroethane4,4'-DDT4,4'-dichlorodiphenyltrichloroethane

DLM designated level methodology DON U.S. Department of the Navy

DQO data quality objective

DTSC Department of Toxic Substances Control

EcoRA ecological risk assessment ECP environmental control plan

EDXRF energy dispersive x-ray fluorescence
EPA U.S. Environmental Protection Agency

FFA Federal Facility Agreement
FWS U.S. Fish and Wildlife Service
HHRA human health risk assessment

HI hazard index HQ hazard quotient

IR Installation Restoration

IRP Installation Restoration Program

IIII CorporationMCBMarine Corps Basemg/kgmilligrams per kilogram

msl mean sea level

NAVD North American Vertical Datum

NOI Notice of Intent OU3 Operable Unit 3

PA/SI preliminary assessment/site inspection

PED planned excavation depth
PLE preliminary limit of exposure
POLs petroleum, oils, and lubricants
PRG preliminary remediation goal

8 1 03

Abbreviations and Acronyms (Cont.)

QC quality control RA remedial action RD remedial design

RD/RA remedial design/remedial action

RI/FS remedial investigation/feasibility study

ROD Record of Decision

RWQCB California Regional Water Quality Control Board

SARA Superfund Amendments and Reauthorization Act of 1986
SWDIV Southwest Division Naval Facilities Engineering Command

SWPPP storm-water pollution prevention plan
UCL₉₅ 95-percent upper confidence limit
VOCs volatile organic compounds

SVOCs semi-volatile organic compounds

Executive Summary

A remedial action was implemented pursuant to the Record of Decision (ROD) for Operable Unit (OU) 3 (OU3 ROD) dated January 11, 1999 (SWDIV, 1999a), for the remediation of soil contamination at Installation Restoration (IR) Site 2A at Marine Corps Base (MCB) Camp Pendleton (base) in San Diego County, California

IR Site 2A was a former grease disposal pit. The site was used by the base between 1942 and the early 1980s for the disposal of mess hall grease generated by the base. IR Site 2A was designated under the MCB Installation Restoration Program (IRP) as a Group D site for conducting the remedial investigation and feasibility study (RI/FS) pursuant to the process mandated by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980. The conclusions from the RI work performed for Group D sites and the RI/FS work for OU3 sites indicated that soil at IR Site 2A was impacted by past disposal activities and could pose a risk to surrounding environmental receptors and human health. As a result, remedial action was required for the protection of human health and the environment.

Remedial actions, based on the OU3 ROD, taken at IR Site 2A include the following:

- Excavation of contaminated soil; the maximum excavation depths were 5 feet for ecological concerns and 10 feet for human health concerns.
- Confirmation sampling of the bottom and sidewalls of the excavation in accordance with Methods for Evaluating the Attainment of Cleanup Standards, Volume I: Soils and Media, PB89-234959, prepared by the U.S. Environmental Protection Agency (EPA).
- Transportation to and disposal of soil meeting technical and legal requirements (i.e., specified in Title 40, Code of Federal Regulations (CFR), Section 264.552[c]) at an on-base landfill, IR Site 7 (Box Canyon landfill), a designated corrective action management unit (CAMU).
- Backfilling of the excavation with clean soil upon confirmation that cleanup standards were met; if standards were not met at the maximum excavation depths (i.e., 5 feet for ecological concerns and 10 feet for human health concerns), placing 5 or 10 feet of clean fill, as relevant.
- Site regrading and revegetating.

A site-specific remedial design/remedial action (RD/RA) work plan was developed to meet the OU3 ROD requirements. The RD/RA work plan provides details on the remedial action (RA) process, site preparation, remedial excavation, waste transportation and disposal, cleanup

confirmation criteria and methodology, and final site restoration approach. The final remedial action for IR Site 2A was implemented in accordance with the RD/RA work plan in 1999 (excavation and disposal) and 2000 (final site restoration).

This report was prepared to document the RA details in accordance with EPA guidance for preparing final RA reports. The report provides an overview of the site-specific background and the decisions pertinent to the development of the final RA, chronology of the RA and construction activities, evaluation of the performance standards and construction quality control, site inspection and certification, post-RA operation and maintenance, and summary of project costs.

The report is supported by five appendices that provide information on the preconstruction biological survey, photographs of construction activities, backfill contractor quality control, site revegetation seed mix, and analytical data summary and documentation.

In summary, the RA at IR Site 2A was conducted in accordance with the approved RD/RA work plan. The total volume of soil removed was approximately 29,341 cubic yards (originally estimated at 15,995 cubic yards) between July and November 1999. The excavated soil from IR Site 2A was transported to and disposed of at a CAMU located at IR Site 7. The cleanup efforts were evaluated in accordance with the RD/RA work plan and found to meet the OU3 ROD requirements and cleanup standards. The excavated site was approved for final backfill and was restored with native vegetation during October 2000. The total cost for conducting the final RA was approximately \$1.098 million (originally estimated at \$0.7 million) in 1999/2000 dollars.

IR Site 2A is considered a clean closure because the residual contamination poses no unacceptable exposure risk to human health or the environment. As such, 5-year reviews, further remedial action, and/or post-RA monitoring and maintenance are not required.

1.0 Introduction

This report was prepared by Shaw Environmental, Inc. (formerly IT Corporation) in partial fulfillment of work scope of Contract Task Order (CTO) No. 0080 issued under Southwest Division Naval Facilities Engineering Command (SWDIV) Remedial Action Contract No. N62474-98-D-2076. This report summarizes the remedial action activities implemented by Shaw Environmental, Inc. at Installation Restoration (IR) Site 2A, 14 Area grease disposal pit, located at Marine Corps Base (MCB) Camp Pendleton in San Diego County, California.

This report will reflect the use of IT Corporation (IT) as the preparer of the report because the activities described in this report were performed by IT before Shaw Environmental, Inc acquired IT in May 2002

1.1 Project Background

MCB Camp Pendleton (base) is the primary amphibious training center for the west coast. Located between the cities of Los Angeles and San Diego, California, MCB Camp Pendleton covers approximately 125,000 acres, almost entirely in San Diego County (Figure 1-1). Surrounding communities include San Clemente to the northwest, Fallbrook to the east, and Oceanside to the south (Figure 1-1). The base is bordered to the west by the Pacific Ocean and encompasses 17 miles of undisturbed coastal area; rolling hills and valleys range inland an average of 10 to 12 miles.

MCB Camp Pendleton and the U.S. Department of the Navy (DON) have been actively engaged in the Installation Restoration Program (IRP) since 1980. The IRP is designed pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by Superfund Amendment and Reauthorization Act (SARA) of 1986, to provide investigation and remediation, if necessary, to environmental impact caused by hazardous substances, pollutants, or contaminants. In general, the IRP consists of the following phases:

- Preliminary Assessment/Site Inspection (PA/SI): The PA/SI process involves records reviews, site inspections, and preliminary sampling and data collection to identify sites that could require further investigation or remediation.
- Remedial Investigation/Feasibility Study (RI/FS): The RI process involves assessing the nature and extent of contamination to a level of detail sufficient to support the development of remedial alternatives, which are then evaluated and finalized through the FS process

• Remedial Design/Remedial Action (RD/RA): The remedial design (RD) process involves developing technical designs and analyses for the remedial alternative selected through the FS process. The detailed design plans and specifications from the RD phase are implemented during the final remedial action (RA) process.

A Federal Facility Agreement (FFA) for the base was signed on October 24, 1990, and constitutes a legally binding agreement between the U.S. Environmental Protection Agency (EPA), the California State Department of Toxic Substances Control (DTSC), the California Regional Water Quality Control Board (RWQCB), and the DON. The FFA outlines the working relationship between the parties to the agreement and clearly defines the mutual obligations of the parties as structured to attain efficient remedial response throughout the process. In addition, the FFA establishes a procedural framework and schedule for developing, implementing, and monitoring appropriate response actions at the base in accordance with the IRP

Based on the PA/SI data, the FFA segregated the IRP sites into four groups:

- **Group A** Sites with previous investigations prior to the RI/FS
- Group B Landfills and surface impoundments
- Group C Remaining sites in the Santa Margarita river basin
- Group D Remaining sites outside the Santa Margarita river basin.

In this grouping process, IR Site 2A was placed in Group D. The RI phase for Group D sites was performed during June and July 1996 (SWDIV, 1997). The FS for IR Site 2A was conducted as part of Operable Unit 3 (OU3) and was finalized in May 1998 (SWDIV, 1998a).

The final remedy for IR Site 2A was selected and documented in the Record of Decision (ROD) for OU3 (SWDIV, 1999a) that was issued in January 1999 and signed by the parties to the FFA during February and March 1999

IR Site 2A is located in 14 Area (Figure 1-2), near the east boundary of the base. The site was one of seven mess hall grease disposal pits scattered throughout the Base. In addition to mess hall grease, petroleum, oils, and lubricants (POLs) may also have been placed in some of the pits. The pits were typically less than 10 feet deep. Grease disposal pits were used between 1942 and 1980 by the base for disposal of mess hall grease. No information is available on the specific years of operation or the amount of grease that was disposed of in the pit at IR Site 2A. A burn pit was also found immediately adjacent to the north of the disposal pit at IR 2A, which may have been used for the disposal of POLs and trash.

The pits at IR Site 2A were closed by allowing the greasy materials to decay to a semisolid state and then backfilling with native soil. Field reconnaissance of the pit did not reveal any obvious stress to local plants and vegetation. Burn debris was observed in areas identified to be the burn pit.

The RI results indicated that site soil posed unacceptable exposure risk to both ecological receptors and human health. The OU3 ROD requires that the burn debris and contaminated soil be removed from the site to the extent that the residual environmental impact and exposure risk, if any, would be acceptable. To achieve this requirement, risk-based remediation standards were developed during the RI/FS process and were then specified in the OU3 ROD. Based on the remediation standards, an RD/RA work plan (SWDIV, 1999b) was developed to provide a detailed approach for conducting remedial excavation, cleanup confirmation, and final site restoration. Contaminated soil removed from IR Site 2A was disposed of in a corrective action management unit (CAMU) located at IR Site 7, Box Canyon Landfill (Figure 1-2).

In accordance with the RD/RA work plan (SWDIV 1999b), IT implemented the RA and excavated and removed about 29,341 cubic yards of burn debris and contaminated soil from the site between July 6 and November 12, 1999. The RA effort was summarized in an interim asbuilt report and addendum (SWDIV, 2000), which were reviewed by the parties to the FFA. The final site restoration plan (presented in the interim confirmation report) was approved by the parties to the FFA during the 56th FFA meeting held on May 15, 2000. The site grade was restored between June 26 and July 13, 2000. A total volume of about 13,793 cubic yards of clean soil was imported from a borrow site located in 22 Area of the base (Figure 1-2) for use as backfill to restore the surface grade. In October 2000, the site was seeded with a mix of native plants approved by the base biologist and the U.S. Natural Resources Conservation Service. Because the RA met all the remediation standards specified in the ROD, no further action was required and the RA at IR Site 2A is now considered complete.

1.2 Report Objectives

The primary objective of this report is to summarize the RA activities performed at IR Site 2A by IT during 1999 and 2000. In addition, chronological events related to the development of the RA, such as the RI/FS, ROD, and RD, are summarized. This report provides the documentation needed for the closure of IR Site 2A from the base IRP listing and future actions.

1.3 Report Organization

This report was prepared in accordance with the EPA guidance for preparing an RA report (EPA, 2000). The report was organized to include the following information:

- Section 1.0 Introduction
- Section 2.0 Site Description and Background
- Section 3.0 Construction Activities and Chronology of Events
- Section 4.0 Performance Standards and Construction Quality Control
- Section 5.0 Final Inspection and Certification
- Section 6.0 Operation and Maintenance Activities
- Section 7.0 Summary of Project Costs
- Section 8.0 References.

In addition to general discussions provided in each section, supporting documents include the following:

- Appendix A Preconstruction Biological Survey Report
- Appendix B Photographs of Remedial Construction
- Appendix C Site Backfill Geotechnical Contractor Quality Control Report
- Appendix D Site Revegetation Seed Mix
- Appendix E Analytical Data Summary and Evaluation
- Appendix F Review Comments.

2.0 Site Description and Background

This sections summarizes the conditions and operational background of IR Site 2A, as well as the RI/FS results, ROD requirements, RD, and the RA work plan that led to the final RA.

2.1 Site Description

This section summarizes the location, operational background, and environmental setting of IR Site 2A. The summary information in the following sections was obtained from the supplemental RI/FS for OU3 (SWDIV, 1998a).

2.1.1 Location

IR Site 2A, a grease disposal pit in 14 Area, is located near the east boundary of the base (Figure 1-2), off Pilgrim Creek East Trails Road (Figure 2-1). The grease disposal pit is located in a flat area of a hill (Figure 2-1). The disposal activity, as evident by the surface debris, expanded beyond the pit area and onto the steep slope area to the west of the pit. The site drains into Pilgrim Creek, an intermittent stream that flows in a stream-cut canyon to the west of the hill. The site is approximately 500-feet long and 400-feet wide (about 2.3 acres).

2.1.2 Operational Background

IR Site 2A is one of seven mess hall grease pits scattered throughout the Base. In addition to mess hall grease, POLs may also have been placed in some of the pits. The pits were typically less than 10-feet deep. Grease disposal pits were used between 1942 and 1980 for disposal of mess hall grease. No information is available on the specific years of operation or the amount of grease that was disposed of in the pit at IR Site 2A. A burn pit was also found immediately adjacent to the north of the disposal pit at IR Site 2A, which may have been used for the disposal of POLs and trash.

The grease pit at IR Site 2A was closed by allowing the greasy materials to decay to a semisolid state and then backfilling with native soil. Field reconnaissance of the pit did not reveal any obvious stress to local plants and vegetation.

2.1.3 Environmental Setting

This section summarizes the topography, geology, hydrogeology, ecology, and land use in the vicinity of IR Site 2A prior to the RA.

Topography – The site is at an average elevation of approximately 353 feet mean sea level (msl) and extends gently toward a steep slope to the west (Figure 2-1). The surrounding area consists of low rolling hills.

Surface Water Hydrology – No perennial surface water is present in the vicinity of IR Site 2A. Surface water at the site is ephemeral and follows the gently sloping ground surface to the southwest. Surface waster, during significant rainfall events, percolates into the subsurface, evaporates, or runs off the site and discharges into Pilgrim Creek.

Geology – Shallow geology at the site is characterized by semi-consolidated to consolidated alluvium consisting of fine- to medium-grained, poorly graded sand, silt, and sand with silt. The alluvium overlies massive granitic Basement rock.

Groundwater Hydrology – Groundwater is assumed to flow to the southwest (following surface topography) based on site geology. Soil borings were drilled to a maximum depth of 20 feet below ground surface at IR Site 2A without encountering groundwater. However, groundwater was encountered at IR Site 1A located in the stream-cut canyon directly west and topographically downslope from IR Site 2A. Groundwater at IR Site 1A was encountered at depths of approximately 5 to 18 feet below ground surface. The depth to groundwater at Site 2A is estimated to be nearly 100 feet below ground surface because IR Site 2A is located on an isolated topographic high approximately 85 feet above IR Site 1A.

Ecology – Vegetation at IR Site 2A was burned during a brush fire in June 1997. Most of the original Coastal Sage Scrub and disturbed habitat was destroyed. The site has sparsely vegetated with fennel, Coyote Brush, Thistle, Mustard, and Wild Oat. Bird species observed during the reconnaissance survey prior to the fire include Mourning Dove and Cliff Swallow.

No Coastal California Gnatcatchers were observed at IR Site 2A during the first three surveys conducted in May 1997. No Arroyo Toads were observed either. Surveys conducted in 1996 identified Least Bell's Vireos in riparian vegetation adjacent to the site.

Surrounding Land Use – The grease disposal pit in 14 Area is no longer in operation, and military and civilian personnel presence at the site is infrequent. No development is located in the immediate vicinity of the site. The undeveloped area surrounding the site is classified as a "maneuver area." The gently sloping topography of this area is covered by natural vegetation. Troop housing is located within the Headquarters Area about ½ mile west of the site. The nearest family housing is approximately 2 miles north of the site.

The future (post-remediation) land use at this site has not been documented. However, the likelihood of future residential land use is considered low, given site location, topography, current development plans and current land use in the vicinity of the site.

No Base production wells are located in the San Luis Rey Basin or within a 1-mile radius of IR Site 2A. Future use of groundwater at the site is considered improbable.

2.2 Summary of RI/FS Results

This section provides a summary of the RI/FS results. The investigations performed for IR Site 2A include the following:

- An RI for Group D Sites was conducted during June and July 1996, and was documented in the *Draft Final RI Report for Group D Sites, Remedial Investigation/Feasibility Study* (SWDIV, 1997).
- A supplemental RI was conducted from May through July 1997, and was documented in the *Draft Final Remedial Investigation and Feasibility Study for Operable Unit-3* (SWDIV, 1998a).
- A field investigation was conducted in May 1998, and is documented in the Energy Dispersive X-Ray Fluorescence (EDXRF) Field Investigation Report, Sites 1A, 1D, 1E, 2A, and 2A (SWDIV, 1998b).

Information extracted from the above reports is summarized with regard to the following:

- Nature and extent of contamination
- Environmental impact
- Development and selection of remedial goals
- Development and selection of remedial alternatives

It should be noted that the following sections contain citations of regulatory criteria, goals, levels, and standards that may have changed over time. The current regulations may not be consistent with the ones cited in the study summarized in this section.

2.2.1 Nature and Extent of Contamination

RI work at IR Site 2A involved surface and subsurface soil sampling to evaluate potential contamination from the grease disposal pit and adjacent burn pit, and potential impact to human health and ecological receptors.

According to the RI results, the groundwater at IR Site 2A is not of concern. Only soil was found impacted by the past activities. An estimated areal extent of contamination was

developed, based on the soil analytical results obtained from the RI, as shown on Figure 2-2. The contamination characteristics is discussed as follows:

Organic Compounds — Two chlorinated pesticides were detected at concentrations at or exceeding preliminary remedial goals (PRGs) at IR Site 2A: 4,4'-dichlorodiphenyldichloroethane (4,4'-DDD) in the 5-foot interval sample, and 4,4'-dichlorodiphenyldichloroethene (4,4'-DDE) in the 5- and 10-foot interval samples from boring 2AB-05. Four volatile organic compounds (VOCs) were detected at low concentrations: acetone, 2-butanone, ethylbenzene, and total xylenes. The highest VOC concentration detected at IR Site 2A was 0.047 milligrams per kilogram (mg/kg) for acetone. Three semi-volatile organize compounds (SVOCs) were detected: benzoic acid (3.8 mg/kg), bis(2-ethylhexyl)phthalate (0.13 mg/kg), and phenanthrene (0.18 mg/kg) were each detected once in borings 2AB-03, 2AB-05, and 2AB-01, respectively. Eight dioxin/furans were detected in the 5- and 10-foot samples from boring 2AB-05 at concentrations of 0.001 mg/kg or less.

1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-HpCDD), 4,4'-DDE, 4,4'-dichlorodiphenyltrichloroethane (4,4'-DDT), and total heptachlorodibenzo-p-dioxins exceeded the preliminary limits of exposure (PLEs) in soil samples collected from boring 2AB-05 during June 1996. The sampling conducted during May 1997 confirmed the presence of the pesticides.

Inorganic Compounds — Nine metals were detected at concentrations exceeding PRGs: antimony, arsenic, beryllium, cadmium, copper, lead, manganese, thallium, and zinc. Although all arsenic detections exceeded the PRG, the concentrations were at or below background. All beryllium concentrations were below the calculated beryllium background level. Antimony, cadmium, copper, lead, manganese, thallium, and zinc concentrations exceeded PRGs and background concentrations in samples from boring 2AB-05. In addition, the lead concentration for the 5-foot sample from boring 2AB-03 exceeded the PRG and background.

Concentrations of aluminum, antimony, barium, boron, cadmium, chromium, cobalt, copper, cyanide, iron, lead, manganese, mercury, molybdenum, nickel, silver, thallium, vanadium, and zinc were reported at concentrations exceeding PLEs in various boring locations. The maximum concentrations of these inorganic constituents also exceeded the background concentrations. Boring location 2AB-05 had the greatest number of inorganic constituents with concentrations exceeding the PLEs. The results of the surface samples collected near boring location 2AB-05 in 1997 are similar to the results of soil samples collected from location 2AB-05 in June 1996.

The May 1998 field investigation (SWDIV, 1998b) involved the collection and analysis of 56 soil samples from hand auger boring locations at Site 2A for purposes of further defining the site boundary. Two of the samples were collected from background locations. The samples were analyzed for the following metals: antimony, arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, thallium, and zinc.

As the EDXRF sampling effort proceeded and the EDXRF screening results were compared to the remedial goals established in the FS, nearly all detections exceeded the remedial goals. A comparison of the EDXRF results and fixed laboratory results showed that the EDXRF results are biased high. EDXRF revised comparison goals were developed to use the EDXRF results for refining the site boundary. These comparison goals were established by collecting soil samples from site-specific background locations for IR Site 2A, analyzing them using EDXRF, and calculating new site-specific background values. In instances where all new background data were non-detect, the original goal was retained. In a few cases where the background value was less than the PRG or PLE, the original PRG or PLE value was retained.

The estimated areal extent of contamination was developed based on the new data collected at IR Site 2A in May 1998, as shown in Figure 2-2, along with the boundary presented in the OU-3 RI/FS (SWDIV, 1998a) and the boundary of debris noted in the soil borings

2.2.2 Environmental Impact

The environmental impact of the site was evaluated by performing a human health risk assessment (HHRA) and an ecological risk assessment (EcoRA). A detailed discussion of the assessments is presented in the RI for Group D sites (SWDIV, 1997). The summary information in the following sections was obtained from the RI/FS for OU3 (SWDIV, 1998a).

Human Health Risk Assessment — Two organic constituents were retained as human health chemicals of concern (COCs): 4,4'-DDE and 4,4'-DDD. These organic compounds generally will adsorb strongly to soil and are not expected to leach into groundwater. Under ordinary environmental conditions, 4,4'-DDE and 4,4'-DDD are not susceptible to significant hydrolysis and biodegradation. Evaporation from the surface of soils with low organic content (such as sandy soils) could be significant, but adsorption of 4,4'-DDE and 4,4'-DDD to soils with high organic content could reduce the rate of evaporation.

Antimony, arsenic, cadmium, copper, lead, manganese, thallium, and zinc are the final human health inorganic COCs. These inorganics are stable in the environment, do not degrade, and migrate slowly through the soil profile. The fate and transport of manganese, thallium, and zinc

are controlled primarily by the pH value and reduction/oxidation potential in the environment. The solubilities of these inorganic constituents in the environment are sometimes also controlled by the availability of certain anions (e.g., carbonate/bicarbonate, sulfate, or hydroxide, etc.). Allowable soil contamination levels calculated using the designated level methodology (DLM) (RWQCB, 1989) indicated that manganese at detected concentrations in the soil is the only metal that could potentially pose a threat to groundwater at Site 2A.

Chemicals of potential concern (COPCs) included metals, VOCs, SVOCs, pesticides, and dioxins/furans. Current/future workers and future residents could be exposed to soil contaminants through incidental ingestion of soil, dermal contact with soil, inhalation of VOCs from soil, and inhalation of soil particulates. This is based on the conceptual site model presented in the RI.

The cumulative residential risk using the maximum concentrations of detected chemicals in soil is 5×10^{-5} . Excluding that portion of the total risk attributable to background metals, the incremental residential site risks based on EPA Region IX and California EPA (Cal/EPA) PRGs are 5.6×10^{-6} and 1.2×10^{-5} , respectively.

The cumulative residential noncancer hazard for the maximum concentrations of chemicals detected in Site 2A soil is 150. The highest detection of contaminants driving both the cancer risk and noncancer hazard were found at boring 2AB-05, which is located in the adjacent burn area. Therefore, the site was viewed as two separate areas: the grease disposal pit area; and the burn area, and the risks were reassessed.

The maximum concentrations for the grease disposal pit, excluding the samples collected from the adjacent burn area at boring 2AB-05, were compared against soil PRGs. The results were a cumulative incremental residential cancer risk of 9.8x10⁻⁶ and a hazard index (HI) of 1.8 (using EPA Region IX PRGs). The only contributors were arsenic and beryllium, both of which were within background concentrations. Subtracting background from the cumulative risk, the incremental residential cancer risks using the EPA Region IX PRGs and Cal/EPA PRGs are less than 1x10⁻⁸ and 1x10⁻⁶, respectively; and the HI is 1.0 for the grease disposal pit area. Soil in this area is considered protective of human health.

The area around boring 2AB-05 presents both unacceptable carcinogenic risk and noncancer hazard. The human health contaminants of concern in this area are 4,4'-DDD; 4,4'-DDE; antimony; arsenic; cadmium; copper; lead; manganese; thallium; and zinc.

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Ecological Risk Assessment – The Baseline EcoRA provides a qualitative and quantitative appraisal of actual or potential effects of contaminants on plants and animals (other than humans and domesticated species). Boron, the inorganic contaminant that exceeded background values, and all organic contaminants were retained for the initial ecological risk screening. Twenty-two chemicals of potential ecological concern (COPECs) (including 18 inorganic constituents, 2 organochlorine pesticides, and 2 dioxin analytes) had hazard quotients (HQs) exceeding 1.0.

The COPECs with HQs greater than 1 were grouped into two areas of concern based on the sample locations where any representative species' PLE exceeded 1.0. Based on the modified PLEs, COPECs with HQs exceeding 1.0 include the following:

- Aluminum
- Antimony
- Barium
- Cadmium
- Chromium
- Cobalt
- Copper
- Iron
- Lead
- Manganese
- Mercury
- Molybdenum
- Nickel
- Silver
- Thallium
- Vanadium
- Zinc
- 4,4'-DDE
- 4,4'-DDT

Biota tissue collected from plants, invertebrates, and mice were compared against reference concentrations to evaluate adverse effects to ecological receptors caused by bioaccumulation. Comparisons against reference concentrations for plants indicated that tissue concentrations of aluminum, cobalt, iron, lead, molybdenum, and silver were elevated. Comparisons against reference concentrations for invertebrates were similar to those for plants. Comparison against reference concentrations for mice indicated that only manganese was present at concentrations slightly elevated above the reference value.

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COPECs that exceeded modified PLEs and retained as COECs include the following:

- Antimony
- Barium
- Cadmium
- Chromium
- Cobalt
- Copper
- Iron
- Lead
- Manganese
- Mercury
- Molybdenum
- Silver
- Thallium
- Zinc.

Aluminum; boron; nickel; vanadium; 4,4'-DDE; and 4,4'-DDT were not retained based on site-specific qualitative factors

2.2.3 Development and Selection of Remedial Goals

The remedial objective for IR Site 2A was to minimize exposure to chemicals in soil at concentrations exceeding the background concentrations, PRGs (for humans), levels considered protective of groundwater, and PLEs (for plants, invertebrates, birds, and mammals). Each criterion was considered in the selection of contaminant-specific remedial goals.

For a given COC, the corresponding human health risk-based standard (i.e., PRGs under a residential scenario) was compared against the background concentration. The background values used were established during the RI and were agreed upon by the regulatory agencies. The higher value of the two is considered the remediation goal for human health protection.

From an ecological perspective, the remediation goal was selected by comparing the background concentration with an appropriate ecological risk management goal and retaining the greater of the two values. The ecological risk management goal for each COC was set at the most stringent PLE for the species of most concern at each site

The lower of the two values (i.e., human health or ecological) was then selected as the proposed remediation goal for the COC in soil ranging between 0 and 5 feet below ground surface. The

remediation goal for human health protection was selected as the proposed remediation goal for COCs in soil ranging between 5 and 10 feet below ground surface.

Finally, the soil concentration limits for the protection of groundwater that were calculated based on the DLM were compared with the proposed remediation goals selected for the protection of human and ecological receptors. The most stringent values were selected as the final proposed remediation goals.

The following compounds were retained as final COCs for Site 2A: antimony; arsenic; barium cadmium; chromium; cobalt; copper; iron; lead; manganese; mercury; molybdenum; silver; thallium; 4,4'-DDD; and 4,4'-DDE. The finalized remedial standards for the COCs at IR Site 2A are presented in Table 2-1

2.2.4 Development and Selection of Remedial Alternatives

Remedial technologies, including institutional action, capping, excavation, landfilling, chemical treatment, physical treatment, biological treatment, and thermal treatment, were evaluated during the development of remedial alternatives. Three remedial alternatives were developed during the FS process as potential RAs for the site:

- Alternative 1 No Action
- Alternative 2 Excavation/Removal and On-Base Disposal
- Alternative 3 Excavation/Removal and Off-Base Disposal.

Remedial alternatives were assessed based on the following evaluation criteria:

- Overall protection of human health and the environment
- Compliance with applicable or relevant and appropriate requirements (ARARs)
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume
- Short-term effectiveness
- Implementability
- Cost...

Alternative 2 was selected as the most effective remedy for IR Site 2A based on the comparative analysis detailed in the RI/FS for OU3 (SWDIV, 1998a). This alternative includes removal of contaminated soil via mechanical excavation. Upon removal, the impacted soil from IR Site 2A was transported to IR Site 7 (Box Canyon landfill), which has been designated as a CAMU for on-base disposal.

Implementation of Alternative 2 was intended to reduce potential future risks to human health and the environment by reducing COCs to PRGs, background, low incremental ecological risk concentrations, and levels protective of groundwater. Future exposure pathways, if any, would be eliminated by backfilling the excavation areas with clean backfill. Because the majority of the impacted soil would be permanently removed from the site, future soil remedial activities would not be necessary. The effectiveness of the soil excavation would be evaluated by collecting and analyzing confirmation samples during excavation.

2.3 Record of Decision

The final remedy for IR Site 2A was issued under the ROD for OU3 sites in January 1999. The ROD was signed by parties to the FFA during February and March 1999. Based on the OU3 ROD, RA activities to be taken at IR Site 2A must consist of the following:

- Excavation of contaminated soil: the maximum excavation depths were 5 feet for ecological concerns and 10 feet for human health concerns.
- Confirmation sampling on the bottom and sidewalls of the excavations in accordance with EPA (1989) guidance.
- Transportation and disposal of soil meeting the technical and legal requirements (i.e., specified in Title 40, Code of Federal Regulations [CFR], Section 264.552[c]) at an on-base landfill (IR Site 7 Box Canyon landfill) designated as a CAMU.
- Backfilling of the excavation with clean soil upon confirmation that cleanup goals were met and, if goals were not met at the maximum excavation depths (i.e., 5 feet for ecological concerns and 10 feet for human health concerns), placing 5 or 10 feet of clean fill.
- Site regrading and revegetating.

2.4 Remedial Design

According to the ROD, previous grease disposal and refuse burning activities impacted soil at IR Site 2A. The residual metal and pesticide concentrations in the site soil would present unacceptable risks to human health and the environmental. Based on the RI/FS results, removal of soil containing COCs with concentrations exceeding the remedial standards (Table 2-1) was determined to be the most effective way to achieve protection of human health and the environment. The detailed approach for conducting the soil removal action was provided in the RD/RA work plan (SWDIV, 1999b), which was reviewed and approved by the parties to the FFA. The RA sequence and decision process, as developed in the RD/RA work plan, is summarized in Figure 2-3. The remedial action at IR Site 2A consisted of the following work:

- Surveying the preexcavation site and laying out the boundary of excavation as identified by the RI/FS process
- Clearing existing vegetation in the excavation area and preparing the site for excavation, temporary soil stockpiles, and transportation operations
- Collecting perimeter confirmation samples at 100-foot intervals to verify the planned excavation boundary
- Conducting removal excavation activities to meet the remedial standards
- Collecting excavation confirmation samples in accordance with the confirmation sampling and analysis program prescribed in the RD/RA work plan
- Transporting the excavated soil to the Box Canyon landfill and placing it in the designated CAMU in accordance with the CAMU design
- Backfilling the excavated areas in accordance with the backfill design and restoring the site drainage grade and vegetation
- Surveying the postexcavation site and preparing an as-built report to document the RA process, confirmation sampling results and analyses, the effectiveness of the RA, and the as-built status of the site.

The following sections summarize the RD approaches and RA decision process

2.4.1 Site Preparation

The planned excavation boundary is shown in Figure 2-4. The extent was based on conclusions from the May 1998 EDXRF investigation (SWDIV, 1998b). The layout of the traffic route, equipment laydown area, and soil stockpile area is also shown in Figure 2-4. Confirmation samples would be collected every 100 feet along the excavation boundary and/or, alternatively, at areas of visible stains or surface contamination to verify the extent of contamination. The results from perimeter sampling would be used to determine whether subsequent changes to the horizontal and vertical extent of the planned excavation would be needed.

Additional site preparation work such as underground utility clearance, surface-water management, traffic control, environmental control, and pollution prevention management were also developed and included in the RD/RA work plan and are discussed in Section 2.4.6.

2.4.2 Remedial Excavation

The remedial excavation, based on the RD/RA work plan, would be started near the top flat areas and proceed to the slope areas. A track excavator would be used for the excavation. The planned excavation depth (PED) is shown in Figure 2-4. The excavation strategy was to minimize the excavation depth while meeting the remedial objectives. In areas where the

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remedial goal was to remove contaminants to eliminate ecological risk and there was no exposure risk to human health, the maximum initial excavation depth would be 5 feet below ground surface. The same strategy would be used for the removal of contaminants posing risk to human health exposure. In the latter case, the maximum initial excavation depth would be limited to 10 feet below ground surface. If the contamination could not be fully removed at the maximum initial excavation depths, further RA, including limited hot spot removal or effective remedial backfill, would be implemented, as required, to remediate the site.

As shown in Figure 2-4, front-end loaders or dump trucks would transport excavated soil to two centralized stockpiles. The stockpile locations were designed to facilitate a traffic routing pattern that would maximize the efficiency of transportation of the excavated soil. The size of the stockpile was designed to encompass an approximate day's worth of work (about 2,000 cubic yards) that could be transported to the CAMU at Box Canyon landfill. The equipment used for excavation and management of contaminated soil would remain within the excavation area. Equipment outside the excavation area would be maintained clean throughout the construction

Excavations would be conducted only in dry weather and low wind conditions. Plastic visqueen and other additional dust control devices would be used depending on weather conditions. Water would be used as the primary dust control media. Workers in the excavation area would be protected in accordance with the site-specific health and safety plan.

2.4.3 Confirmation of Remedial Action

The OU3 ROD requires that confirmation sampling be performed on the bottom and sidewalls of excavations in accordance with EPA (1989) guidance. According to the RD/RA work plan, the confirmation sampling program would start with collection of perimeter confirmation samples along the preexcavation boundary. Samples would be collected at 100-foot intervals along the perimeter and from half and full depths of the planned excavation. These perimeter samples would be used as the wall confirmation samples. Floor samples would be collected from the excavated surface and from 2 feet below the bottom of the excavation after the planned depth was reached. The surface samples would be analyzed first to assess the effectiveness of excavation. Should the surface sample exceed the remedial goals, below-grade samples would be analyzed to assess the extent of contamination.

The primary criterion for confirming that the cleanup standards are met is that 95-percent upper confidence limit (UCL) of the confirmation sample mean must be equal to or less than the specified cleanup standard. To achieve this, floor confirmation samples would be systematically collected from a square grid pattern of 67 by 67 feet. The starting point of the sample grid would

be randomly selected prior to the remedial excavation. The grid space and number of samples were designed and determined in accordance with the statistical test method provided in the EPA (1989) guidance. The sampling grid was designed such that the confirmation sampling data would meet certain data quality objectives to be verified by statistical tests. The data quality objectives were to achieve the following:

- Less than 5 percent probability that a residual hot spot with a size larger than a radius of 40 feet was left undetected
- A confidence level of 95 percent (false positive rate of 5 percent) at a risk of 20 percent (false negative rate of 20 percent) when the site was declared remediated with regard to meeting the cleanup standards

If the above objectives could not be met through statistical tests, data would be evaluated manually following the data evaluation process presented in Figure 2-5. Because the site contained multiple COCs, it would be possible that removal of some of the COCs would be more difficult than for others. In such a case, multiple criteria would be applied, on a case-by-case basis, for developing the most appropriate action for achieving site closure. The evaluation criteria would include the extent, concentrations, and characteristics of the residual contamination; the risk associated with exposure to such contamination; the cost-effectiveness of additional removal excavation and effective remedial backfill; and future use of the site. The subsequent RA included the following alternatives depending on evaluation of the above criteria:

- No Further Action The evaluation indicates that the risk associated with exposure to such residual contamination is low due to the characteristics (i.e., residual concentration, final location, and exposure pathway) of the contaminant and future use of the site. In such a case, the site would be backfilled and restored.
- Hot Spot Removal If the evaluation indicates that the residual contamination is limited and could be economically removed with additional excavation or that the exposure risk could be effectively reduced by additional excavation, hot spots would be identified and removed with additional excavation. Additional confirmation samples would be collected and new data would be added to the original data pool for analysis.
- Remedial Backfill If the evaluation indicates that the contamination could not be economically removed to meet the remedial goals or effectively reduce the exposure risk, the maximum excavation depths would remain 5 feet below ground surface for contamination involving ecological risk and 10 feet below ground surface for human health risk. The site would then be backfilled and restored with clean soil to a minimum depth of 5 feet to eliminate future risk of ecological exposure to residual contamination or to 10 feet to eliminate human health exposure. The area requiring remedial backfill would be identified so that the final

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grade of the restored site could meet the minimum depth requirements, as well as drainage and erosion control needs

2.4.4 Transportation and Disposal

According to the RD/RA work plan, excavated material from IR Site 2A would be placed in dump trucks and covered with tarps prior to being transported to the CAMU at the Box Canyon landfill (IR Site 7). The transport trucks would access the site via a dedicated haul road (Figure 2-4), maintained and kept free of impacted soil from the excavation area. Signs and guide markers would be used to prevent trucks transporting impacted soil to the landfill from driving over contaminated soil at the excavation site. A separate decontamination area would be maintained at the site to clean the tires and other exterior surfaces of any transfer trucks, if necessary, prior to their leaving the site.

The soil excavated from IR Site 2A would be contained in the designated CAMU at the Box Canyon landfill. The RD concluded that an estimated 15,995 cubic yards of excavated soil would be deposited in the CAMU and eventually covered with a minimum 6 feet of clean soil designed for the closure of Box Canyon landfill.

2.4.5 Site Restoration

The backfill grade in the RD was to eliminate the residual risk, if any, associated with the COCs and to restore the existing drainage patterns on the site. After the site grade was restored, the disturbed areas would be revegetated with native plant species to restore the vegetation.

2.4.6 Environmental Control Plan

An environmental control plan (ECP) was prepared to provide specific information related to the excavation and disposal of contaminated soil to ensure adequate environmental protection during remedial activities. Specific environmental protection issues addressed by the ECP were as follows:

- Land resources management
- Water resources protection (spill prevention and control)
- Storm-water pollution prevention plan (SWPPP) (meeting RWQCB storm-water discharge permit requirements per the National Pollutant Discharge Elimination System mandate)
- Wildlife resources management (biological monitoring in accordance with biological assessment recommendations)

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Dust/airborne contaminant control and monitoring

- Traffic control, in accordance with California Department of Transportation (CalTrans) manual (CalTrans, 1996)
- Noise control
- Erosion control and winterization (in accordance with RWQCB best management practices).

2.4.7 Regulatory Permitting

Although permits are not required for implementing a CERCLA RA, all construction activities were conducted in full compliance with the substantive requirements of applicable permits. A notice of intent (NOI) and SWPPP were submitted to the RWQCB as required for any construction activities involving grading work greater than 5 acres. Although the planned grading work at IR Site 2A was less than 5 acres, the RA activities were managed under one integrated SWPP developed for the entire OU-3 RA (i.e., CAMU and other OU-3 RA sites). The SWPPP was a part of the RD/RA work plan.

3.0 Construction Activities and Chronology of Events

In accordance with the RD/RA work plan (SWDIV, 1999b), the remedial action process at IR Site 2A consisted of the following tasks:

- Surveying the preexcavation site and laying out the excavation boundary identified by the RI/FS process
- Clearing existing vegetation in the excavation area and preparing the site for excavation, temporary stockpiling, and transportation operations
- Collecting perimeter confirmation samples at 100-foot intervals to verify the planned excavation boundary
- Excavating soil to meet the remedial goals
- Collecting excavation confirmation samples in accordance with the confirmation sampling and analysis program, and evaluating the confirmation data in accordance with the decision process
- Transporting the excavated soil to the Box Canyon landfill (Site 7) and placing it in the designated CAMU in accordance with the CAMU design
- Backfilling the excavated areas in accordance with the backfill design and restoring the site drainage grade and vegetation
- Surveying the postexcavation site and preparing an as-built report to document the RA process, confirmation sampling analyses and results, effectiveness of the RA, and as-built status of the site.

This section provides a chronology of the various construction activities conducted since the start of construction in June 1999. The chronology is divided into four stages based on the types of field activities: preexcavation, excavation, confirmation sampling, and final site restoration. Each stage is discussed separately in the following sections.

3.1 Preexcavation Activities

Several tasks were performed to prepare the site for construction before the start of soil removal activities at IR Site 2A, including site surveying, perimeter confirmation sampling, preconstruction biological surveying, and site preparation.

3.1.1 Preconstruction Site Survey

In accordance with the work plan (SWDIV, 1999b), the planned excavation boundary, shown in Figure 2-4, was surveyed and marked on the ground. In general, surveyors placed stakes at

100-foot intervals along the excavation to delineate the excavation boundary. Additional stakes were positioned between curves. Each stake was offset 3 feet outward from the actual boundary to accommodate the sloping factor from the remedial excavation (i.e., the remedial excavation starts at the staked line). The stakes were identified by the site number and a four-digit number designated by the surveyors. All surveys were conducted under the supervision of a California-registered licensed land surveyor using the State Plane Coordinates based on the North American Vertical Datum (NAVD) of 1988.

3.1.2 Perimeter Sampling

In accordance with the work plan, perimeter samples were collected at 100-foot intervals to verify the planned excavation boundary. A total of 13 perimeter sample locations were identified as part of the preconstruction boundary survey. The site boundary and stake locations are shown in Figure 3-1. In accordance with the RD/RA work plan (SWDIV, 1999b), soil samples were collected using a hand auger on March 29 and 30, 1999. Two samples were collected from each boring, one at half of the PED and the second at full depth. The perimeter samples were also used as wall confirmation samples. In accordance with the work plan, only the half-depth sample at each location was initially analyzed. The initial perimeter confirmation sampling results (Table 3-1) indicated that, with the exception of iron, only two isolated locations (samples 2A-1097 and 2A-1104) required further action. Additional step-out samples were collected at these locations during the course of the excavation. Additional step-out sampling is discussed in Section 3.3. In six perimeter sampling locations (samples 2A-1099, 2A-1100, 2A-1102, 2A-1103, 2A-1105 and 2A-1106), the iron levels were above the cleanup standard while other COCs were at acceptable levels. The issues on elevated iron levels were further discussed in Section 4.2 when the effectiveness of the remedial excavation is evaluated.

3.1.3 Biological Assessment

As a result of a meeting with the U.S. Fish and Wildlife Services (USFWS) on May 20, 1999, it was decided that a preconstruction biological survey should be conducted to verify potential biological impacts, if any, as analyzed in the biological assessment (SWDIV, 1999c). The preconstruction biological survey for IR Site 2A was conducted on June 23, 1999, by a biologist qualified and permitted to survey for the California Gnatcatcher, Southwestern Willow Flycatcher, Least Bell's Vireo, California Least Tern, And Arroyo Toad. Findings from the survey confirmed the results of the biological assessment (SWDIV, 1999c). The assessment concluded that mitigation measures were not required at IR Site 2A because of insufficient reestablishment of vegetation following the brushfires of 1997. Approval for clearing and

grubbing activities was given on the day of the biological survey. A copy of the preconstruction biological survey report is presented in Appendix A.

3.1.4 Site Preparation

The majority of the site preparation activities were performed between June 25 and 29, 1999, and included the following:

- Mobilizing equipment and personnel
- Obtaining clearances for underground utilities
- Obtaining access to a water supply and approval on a backflow prevention device
- Setting up an on-site staging area, fuel storage and containment system, storage and restroom facilities, and personnel rest/decontamination areas in accordance with the work plan (SWDIV, 1999b)
- Installing temporary fencing (bright-orange plastic mesh fence) along the entire excavation boundary and warning signs (stating Danger Hazardous Waste Area, Unauthorized Personnel Keep Out) at locations opening to off-site traffic
- Building an on-site access road for truck operations
- Installing signs along the trucking route between IR Sites 2A and 7
- Clearing and grubbing vegetation
- Installing surface-water management (temporary diversion soil berms) and erosion control devices (silt fence and straw bales) at the stockpile location and along the streambed as preventive measures
- Installing survey control points, grade stakes, and interior excavation boundaries
- Establishing a grid system for collecting floor confirmation samples

According to the work plan, a grid pattern of 67- by 67-foot squares (Figure 3-1) was laid out from a randomly selected starting point. Floor confirmation samples were collected from the node points, as required.

The site preparation work was completed on June 29, 1999. The site plan is shown in Figure 3-2. In addition to the above activities, 18 test trenches were dug on June 29 and 30, 1999, at various locations throughout the site to confirm the depth and characteristics of the contaminated soil. Trenching activities revealed that burned debris exceeded the PEDs in the west-central portion of the excavation area. It was decided that the confirmation samples collected from the excavation floor at the planned depth would determine whether additional removal action was required in that area.

No unusual types of wastes (e.g., unlabeled drums or containers with unknown contents) were identified during the site clearing and test trenching process.

3.2 Remedial Excavation Activities

Remedial excavation activities at IR Site 2A began on July 6, 1999. The excavation was generally conducted in the following three phases:

- Planned Excavation: Although the initial test trenching indicated that the waste depth in certain areas exceeded the PED, it was decided that the first phase of the excavation would be terminated at the planned depth. Floor confirmation samples would be collected to assess whether residual contamination was present and further excavation was required.
- Overexcavation: If the floor confirmation sample collected at the PED exceeded the cleanup standard, overexcavation was conducted to remove the contamination. At IR Site 2A, overexcavation essentially removed all visible waste debris. New floor confirmation samples were collected after the overexcavation was completed.
- Final Excavation: Additional excavation was conducted in localized areas to remove contaminated soil that exceeded cleanup standards. At IR Site 2A, the final excavation essentially removed all unacceptable contamination and established that cleanup objectives were met for the entire site.

The following sections summarize the excavation activities performed during each of the three phases and the total quantity of waste removed from IR Site 2A. Photographic documentation of the removal excavation process is presented in Appendix B.

3.2.1 Planned Excavation

The first phase of the remedial excavation process began on July 6, 1999. Excavation of contaminated soil began at Area 3 (Figure 3-2) near the eastern side of IR Site 2A. The eastern half of IR Site 2A is relatively flat while the western half is on a fairly steep slope. Two track excavators were used as the excavation gradually extended into the western side. Target depths ranged from 3 to 10 feet and were verified daily using surveyor's grade stakes, unexcavated soil monuments (removed during overexcavation phase), or sidewall measurements. Excavated waste and soil were transported to the two temporary stockpile areas (Figure 3-2) by a bulldozer or wheel loader. Stockpile and loading areas were constructed for both the western (lower) and eastern (upper) areas because of the steep grade changes over the site. Wheel loaders or track excavators were used to transfer the stockpiled soil into a 20-cubic-yard end-dump truck.

Excavated waste and contaminated soil were transported to the CAMU at IR Site 7(Box Canyon landfill) for final disposal. Signs identifying the trucking route were installed at all major road

crossings. All trucks were required to use tarps to cover the waste. No trucks were allowed to leave the site without proper tarp covers. Remedial excavation continued in this fashion until July 29, 1999, when the PEDs for the western and eastern areas were reached.

Several soil monuments (see photograph in Appendix B) were left in place and used by the equipment operator for visual control of excavation depth to accommodate the steep grade changes over the eastern and western sides of the site. These monuments were removed as part of the overexcavation phase as discussed in the following sections.

3.2.2 Overexcavation

Inspection of the floor throughout the planned excavation activities revealed ash-like soil in selected areas. The initial floor confirmation sampling results (Table 3-2) indicated that these areas (mainly along the C and D grid lines in Figure 3-1) exceeded the cleanup standards for the COCs. It was decided based on these results that additional excavations would be conducted to remove all visible burned debris and ash material in order to meet the remedial cleanup goals for the site.

Between July 30 and August 2, 1999, prior to any additional overexcavation, additional test trenching was conducted in the debris area to verify the depth of the remaining debris layer. Trenching revealed large concrete debris near grid locations C3 and D4 that were not identified in the pre-excavation trenching. The concrete debris was buried in a trench that extended 8 to 10 feet below the PED. Besides the concrete debris, the characteristics of the burn ash and debris were consistent with the debris encountered during the planned excavation.

Overexcavation operations began on August 3 and continued until September 24, 1999. The methods used to remove the additional contaminated soil were similar to those used during the initial excavation. The overexcavation areas included all areas with visible debris and any locations identified by the initial confirmation results.

At the completion of the overexcavation phase, all visible burn debris and ash had been removed. Several iterations of overexcavation were performed during this stage as a result of elevated pesticide concentrations found in debris-free soil. In general, areas along the C grid line were overexcavated the greatest number of times. Pockets of discolored (olive-green, black) oily soils not seen during the planned excavation stage were found near grid points C4, D4, and D5. The discolored soils were believed to be the degraded mess hall grease and had a elevated organic vapor reading up to 200 part per million in breathing zone when measured with an organic vapor

analyzer. The discolored soils were subsequently removed to the underlying weathered bedrock layer.

About 400 cubic yards of concrete debris were excavated out during this stage. About 250 cubic yards of these were transported to the CAMU at IR Site 7 for final disposal. The rest were stockpiled near grid point C3 area. The majority of the remaining concrete debris was very large pieces that appeared to be foundation slabs. It was decided that, because the concrete debris had no burn marks or discoloring on the surface, the concrete debris was not related to the soil contamination at this site and would not pose risks to human health or the environment. Based on this conclusion, the concrete debris was not removed from the site and was used to backfill some of the deeper excavation for erosion control (see photograph in Appendix B). Table 3-3 summarizes the floor confirmation sampling results at the end of this stage. Interim data from sampling locations that were subsequently overexcavated are not included in this report.

3.2.3 Final Excavation

Analytical results for samples collected following overexcavation activities indicated that six locations (sampling grid locations B2, B5, C2, C3, C5, and F6 in Figure 3-1) required additional excavations to reduce the levels of residual contamination. The final excavations at B5, C5, and F6 were conducted in accordance with the "hot spot removal" procedure presented in Appendix B of the work plan (SWDIV, 1999b). These grid locations were excavated an additional 2 feet to meet cleanup standards by removing all materials within half the distance to the surrounding four grid nodes. The upper stockpile and loading area was scraped during the final load-out process, and a pocket of discolored oily soil similar to what was found in the overexcavation stage was encountered. The pocket extended eastward to grid point E5 and southward to D6. The discolored soils were removed to the underlying native soil layer (weathered bedrock). The final excavation was completed on November 12. Final confirmation results and an evaluation of effectiveness of the remedial excavation are discussed in Section 3.3.

3.2.4 Excavation Quantities

The total excavation quantities were based on in-place cubic yards of material transported to the CAMU. The daily trucking record is summarized in Table 3-4. A total of 2,257 loads were recorded. An approximate value of 13 in-place cubic yards per truck was calculated based on loading observations and calculations from surveys at the CAMU. According to this estimate, the total quantity of waste materials removed from IR Site 2A was about 29,341 cubic yards, or about 13,346 cubic yards more than estimated in the work plan.

3.3 Confirmation Sampling Activities

The OU3 ROD (SWDIV, 1999a) identified the COCs for IR Site 2A as antimony, arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, silver, thallium, zinc, 4,4'-DDD, and 4,4'-DDE. Site-specific soil cleanup standards (Table 2-1) were specified for soil depths extending from ground surface to 5 feet below ground surface and from 5 to 10 feet below ground surface. For a given COC, HHRA-based standards (i.e., PRGs) and ecological exposure limits (i.e., PLEs) were compared against established site background concentrations and the higher value for each COC was selected as the cleanup standard. However, because both human and ecological receptors could potentially be exposed to the upper 5 feet of soil, the cleanup standards for human health and ecological concerns were evaluated jointly and the more stringent (lower) of the two values was selected as the final cleanup standard for the 5-foot depth.

In accordance with the work plan (SWDIV, 1999b), floor confirmation soil samples were collected at each node of a grid system composed of 67- by 67-foot squares (Figure 3-1). A hand auger was used to collect soil samples at depths of 6 inches and 2 feet below the bottom surface of the excavation. The 6-inch samples were analyzed first to assess the effectiveness of the remedial excavation. If the 6-inch sample exceeded the remediation goals, the 2-foot sample was analyzed to assess the extent of contamination. Surveyors maintained grid node locations and elevations throughout remedial excavation activities. Each sample was identified with a unique sample identifier consisting of the five-digit project number and a sequential number generated at the time of sample collection and documented on the chain-of-custody forms.

Collection of the excavation confirmation samples began on July 20, 1999. Excavation floor confirmation samples were collected continuously and systematically when the PED was reached. In general, the samples were collected in three phases: planned excavation phase, overexcavation phase, and final excavation phase. The three phases are discussed in the following sections.

3.3.1 Planned Excavation Phase

Sampling for the planned excavation activities was completed on July 27, 1999. A total of 40 samples (not including quality control [QC] samples) were collected from the 21 grid point locations initially established. Initial sampling results are presented in Table 3-2. Two grid locations (F3 and E4) were only sampled to a depth of 6 inches because of refusal. Sampling locations and elevations were surveyed after excavation activities were completed to verify that the planned removal depth had been achieved.

As discussed in Section 3.1.2, the preconstruction perimeter sampling results indicated that additional step-out sampling was required at sample location 2A-1097 and 2A-1104. On July 6, 1999, step-out samples were collected at 10 and 20 feet outward from the sample location 2A-1097 and at 10, 20, 30, and 40 feet from 2A-1104. Results for these samples indicated that the existing boundary needed to be extended 20 feet at 2A-1097 and 40 feet at 2A-1104 (Figure 3-1) in order to meet the required cleanup standard. The additional excavations at these locations were conducted during the overexcavation phase.

3.3.2 Overexcavation Phase

Eleven additional floor confirmation samples were collected after overexcavation based on an evaluation of the initial round of confirmation data. Six of these 11 locations, (grid locations B2, B5, C2, C3, C5, and F6 in Figure 3-1) required additional soil removal during the final excavation phase to reduce the cumulative level of residual contamination. Confirmation sampling results at the completion of the overexcavation stage are presented in Table 3-3. The sequence of sampling at each grid point is indicated by a number following the sample location number (e.g., 2AC2-03 means the third sample collected from grid location C2). Interim sampling results are not included in Table 3-3.

3.3.3 Final Excavation Phase

After overexcavation activities were complete, sample results indicated that soil in the vicinity of grid locations B2, B5, C2, C3, C5, and F6 (Figure 3-1) required further removal. Analysis of the 2-foot samples collected from these locations indicated that it would meet the cleanup standards. One additional floor sample was collected from grid location E5 as a result of overexcavation of the discolored oily soil found near the upper loading area (see discussion in Section 3.2.3). The sample collected during the planned excavation stage indicated that the soil above the discolored layer was clean. Therefore, the area was probably covered with clean soil after the disposal activities ceased.

One additional grid location, D6, was added as a result of overexcavation beyond the planned excavation boundary near the upper loading area (Figure 3-2). The sampling result from D6 was also used as the new perimeter confirmation data for perimeter sample location 2A-1103 (new perimeter location is designated as 2A-1103-25).

At this stage, the confirmation data from both the perimeter and floor sampling activities indicated that the remedial excavation at Site 2A satisfied the remedial cleanup standards for the entire site with the exception of iron. The iron cleanup standard was discussed in the 52nd FFA meeting held on November 8, 1999 (SWDIV, 1999d). It was decided that the residual level of

iron found at this site would not warrant further removal excavation. Additional discussions on the iron issues and the overall effectiveness of remedial excavation were presented in Section 4.0.

3.4 Site Restoration Activities

A site restoration plan was presented in the interim as-built report (SWDIV, 2000). The results were presented and discussed during the 53rd and 54th FFA meetings held on January 11 and February 29, 2000, respectively. The confirmation data indicated that the remedial excavation met the cleanup standards. The site restoration plan was subsequently approved during the 56th FFA meeting held on May 17, 2000.

The final site restoration was conducted between June 26 and July 14, 2000. A volume of about 18,500 cubic yards of clean soil was imported from a borrow site located in 22 Area of the base (Figure 1-2) and was used as backfill to restore the surface grade. The site drainage pattern was also restored to preexcavation conditions. Because the majority of the site was on slopes, the imported soil was compacted in 1-foot lifts to a minimum of 90 percent of the maximum dry density as determined by American Society for Testing and Materials (ASTM) D 1557 method. A geotechnical subcontractor performed field method QC activities to verify that the backfill was properly compacted and graded in accordance with the final site restoration plan. The subcontractor's field QC report is presented in Appendix C. The final site grade is shown in the as-built topography map presented in Figure 3-3. During October 2000, the site was seeded with a mix of native plants that was approved by the base biologist and the U.S. Natural Resources Conservation Service. The seed mix specification is presented in Appendix D.

4.0 Performance Standards and Construction Quality Control

Remedial actions taken at IR Site 2A must include the following based on the OU3 ROD (SWDIV, 1999a):

- Excavation of contaminated soils: The maximum excavation depths were 5 feet for ecological concerns and 10 feet for human health concerns.
- Confirmation sampling on the bottom and sidewalls of the excavation in accordance with EPA (1989) guidance.
- Transportation and disposal of soil meeting the technical and legal requirements (i.e., specified in 40 CFR 264.552[c]) at an on-base landfill (IR Site 7 Box Canyon landfill), a designated CAMU
- Backfilling of the excavation with clean soil upon confirmation that cleanup goals were met; if goals were not met at the maximum excavation depths (i.e., 5 feet for ecological concerns and 10 feet for human health concerns), 5 or 10 feet of clean fill was placed, as appropriate.
- Site regrading and revegetating.

An RD/RA work plan (SWDIV, 1999b) was developed to establish specific methodology and performance standards for meeting each of the above requirements. This section provides a review of actions taken to meet each of the OU3 ROD requirements listed above in terms of performance or quality standards specified in the RD/RA work plan.

4.1 Excavation of Contaminated Soil

The remedial excavation was conducted in accordance with the excavation plan (Figure 2-4). The excavation strategy was to minimize the excavation depth while meeting the remedial objectives. In the area where the remedial goal was to remove contaminants to eliminate ecological risk and exposure risk to human health was not a concern, the maximum initial excavation depth was 5 feet below ground surface. The same strategy applied for the removal of contaminants posing risk to human health exposure. In the latter case, the maximum initial excavation depth was 10 feet below ground surface. If the contamination could not be fully removed at the maximum initial excavation depth, further remedial activities, including limited hot spot removal or effective remedial backfill, were implemented as required to remediate the site.

Surveyors maintained grid node locations and elevations throughout the excavation process. The "as-built" condition at the completion of the remedial excavation was surveyed on November 12,

1999, and is shown in Figure 4-1. The final excavation depth and the PED at each grid node are listed in Table 4-1. The excavation depth was determined when floor confirmation samples were collected. As shown in Table 4-1, final excavation depths at all nodes met or exceeded the PED. The extent of excavation was about 4.6 feet (average) deeper and 6,350 square feet wider than the original plan to meet the cleanup standards.

4.2 Confirmation of Excavation Effectiveness

A sampling grid system and sampling strategy were developed in the RD/RA work plan based on EPA (1989) guidance for evaluating cleanup efforts. The data quality objectives (DQOs) of this sampling approach were met by achieving the following performance standards:

- Wall/perimeter confirmation samples were collected at intervals of 100 feet along the excavation boundary identified by the RI/FS process.
- Floor confirmation samples were collected in a systematic grid pattern with a randomly selected starting point
- The grid spacing was designed to allow a 95 percent probability of detecting any residual hot spot with a radius larger or equal to 40 feet.
- The total number of sample satisfied the statistical test requirement for verifying that the decision error was within the tolerance (i.e., false positive rate of 5 percent and false negative rate of 20 percent). In addition, the minimum sample number was 20

The size of the floor sampling grid was 67 by 67 feet to meet the DQOs. A total of 22 floor grid locations within the excavation boundary were sampled along with 13 perimeter locations.

Throughout the RA process, a total of 37 perimeter samples were collected from 13 locations (as planned) and 86 floor samples were collected from 22 grid points (21 points from the planned excavation and 1 point from the overexcavation). Only 75 of these samples were analyzed. The other samples were not tested primarily because a sample from the same sampling location indicated that the cleanup standard had already been achieved. The final excavation boundary, postexcavation site grade, and the final confirmation sampling locations are shown in Figure 4-1.

All confirmation samples were collected, preserved (only as required), shipped, and analyzed in accordance with the field sampling plan presented in the work plan (SWDIV, 1999b). The analytical data summary, chain-of-custody forms, and data validation summary report are presented in Appendix E. The original laboratory data reports and data validation details are too voluminous to be included in this report. The data are maintained by the Navy administrative record archive and are available for review upon request.

4-2

In accordance with DQOs presented in the work plan, the primary criterion for confirming that the cleanup standards had been achieved was that the UCL₉₅ for the confirmation sample mean was equal to or less than the specific cleanup standard. The UCL₉₅ was calculated and updated continuously, during the remedial excavation process whenever new confirmation sampling data were added to the database. The calculated UCL₉₅ was compared against the remedial standards for the excavation depth until the cleanup standard was met.

The results of final UCL₉₅ computation and the associated perimeter and floor confirmation sampling results that were used for the final UCL₉₅ computation are presented in Tables 4-2 and 4-3, respectively. The following additional information is also provided in the tables:

- Grid location The node identifier represented by an alphanumeric designation
- Sample location number The number assigned to each sample, identifying the site number, grid location, and the sequential number of samples collected at the grid location
- Sample depth The depth below ground surface from which the sample was collected
- Collection date The date the sample was collected
- The calculated mean, standard deviation, and UCL₉₅...

The final UCL₉₅ data indicated that, with the exception of iron and 4,4'–DDE of perimeter samples, the remedial excavation successfully met the cleanup standards for all COCs and the statistical DQO criteria. In addition, the UCL₉₅ was below the most stringent cleanup standard; as such, the site could be restored and backfilled without any thickness limitation other than to support future vegetation and drainage control. The UCL₉₅ of 4,4'–DDE for perimeter samples is 1.5 µg/mg, slightly above the PRG-based cleanup standard of 1.3 µg/mg. Isolated residual contamination (at perimeter sampling locations 1101 and 1107) is at such a level that it should not pose any significant risk to human health or the surrounding environment and does not warrant further excavation.

Variance to Iron Cleanup Standard. The residual iron concentration and the iron cleanup standard were discussed in the 52nd FFA meeting held on November 8, 1999 (SWDIV, 1999d and DTSC, 1999). The UCL₉₅ of iron concentrations along the planned excavation boundary (Table 4-2) at IR Site 2A (23,275 mg/kg) was higher than the iron cleanup standard (20,200 mg/kg). The iron cleanup standard was established primarily for the protection of ecological receptors. The cleanup standard was based on the background concentration because

4-3

the calculated/theoretical concentration for protection of ecological receptors is lower than the background concentration. The background level for IR Site 2A was based on general soil data for 13 Area (about 1 mile east of IR Site 2A) and not site-specific. To evaluate the iron background level at IR Site 2A, five additional soil samples were collected from randomly selected locations 200 feet away from the excavation boundary (Figure 4-2). It was found that the iron levels were about the same as found near the excavation perimeter (Figure 4-2) and did not show any discernible pattern of elevated distribution. Considering that UCL₉₅ of iron concentrations from the final floor (Table 4-3) and perimeter (Table 4-2) confirmation data are both within 15 percent of the cleanup standards and that the cleanup standard is background-based, the residual iron concentration should not pose any significant risk to the surrounding environment. The above justification was presented in the 52nd FFA meeting and, as a result, the FFA members in a conference call held on December 2, 1999 approved a variance to the iron cleanup standard (DTSC, 1999). The residual iron level was deemed acceptable and no additional cleanup effort for iron would be required.

4.3 Waste Transportation and Disposal Activities

Excavated waste and contaminated soil were transported with end-dump trucks to the CAMU at IR Site 7 (Box Canyon landfill) for final disposal. Signs identifying the trucking route were installed at all major road crossings. All trucks were required to use tarps to cover the waste. No trucks were allowed to leave the site without proper tarp covers. The trucking route was maintained free of contamination at all times, and a separate decontamination area was maintained at the site to clean the tires and other exterior surfaces of any transfer trucks, if necessary, prior to their leaving the site.

The remedial excavation at IR Site 2Awas initiated on July 6, 1999. Between July 12 and November 12, 1999, a total of 2,257 truckloads (Table 3-3) were recorded. Each truckload was about 20 tons in weight, or 13 cubic yards in volume. Therefore, the estimated volume of waste excavated was 29,341 cubic yards. The work plan had estimated a total of 15,995 cubic yards. It appears that the actual excavation was deeper (Table 4-1) and larger (Figure 4-1) than planned Throughout the transportation and disposal activities, no traffic accidents or violations were recorded. The trucker's daily log/ticket was used as a proof of loads and showed the starting and ending time for each load during each day.

4.4 Site Backfilling and Restoration Activities

The effectiveness of the remedial excavation was evaluated in accordance with the EPA guidance (1989). The evaluation (Section 4.2) confirmed that the soil contamination at IR

Site 2A has been remediated to meet the cleanup standards stipulated in the OU3 ROD. As such, the site no longer posed a threat to the surrounding environment or human health. In accordance with the work plan, the site grade was restored to promote drainage and support vegetation growth. The backfill soil was compacted in 1-foot lifts. The goal of the compaction effort was to achieve 90-percent maximum density, as determined by ASTM D 1557. The compaction effort was verified by field QC testing, as specified in the work plan.

The final site restoration was conducted between June 26 and July 24, 2000. A volume of about 18,500 cubic yards of clean soils was imported from a borrow site located in 22 Area of the base (Figure 1-2) and used as backfill to restore the surface grade. The site drainage pattern was restored to match preexcavation conditions. The imported soil was compacted in 1-foot lift to about 90 percent of the maximum dry density as determined by ASTM D 1557 in all areas. The surface layer was then scarified and loosened to enhance revegetation growth. A geotechnical subcontractor performed field QC activities to verify that the backfill was properly compacted and graded in accordance with the final site restoration plan. The subcontractor's field QC report is presented in Appendix C.

The site was seeded during October 2000, with a mix of native plants approved by the base biologist and the U.S. Natural Resources Conservation Service. The seed mix specification is presented in Appendix D. The success of the site revegetation effort can be demonstrated by photographs (Appendix B) taken in April 2001.

5.0 Final Inspection and Certification

The final remedial action at IR Site 2A was implemented in accordance with the RD/RA work plan (SWDIV, 1999b), which was specifically developed to meet the OU3 ROD (SWDIV, 1999a). The remedial actions were performed in the following sequence:

- Site preparation: June 25 through 29, 1999
- Remedial excavation: July 6 through November 12, 1999
- Transportation and disposal of excavated wastes: July 12 through November 12, 1999
- Interim confirmation report and site restoration plan (SWDIV, 2000): January 11, 2000
- Site restoration plan approved: May 17, 2000 (during 56th FFA meeting)
- Site restoration backfill: June 26 through July 24, 2000
- Site revegetation (hydroseeding): October 2000

Parties to the FFA during the RA, visited the site on August 20, 1999 (as part of 51st FFA meeting), and observed the remedial excavation, transportation, and the CAMU disposal activities. The status of the RA were presented and discussed in FFA meetings subsequent to the start of the fieldwork. This included interim confirmation data analysis, excavation boundary changes (both horizontal and vertical extent), and production quantities. The final extent of the excavation indicated that it was, on the average, about 4.6 feet deeper and 6,350 square feet larger than the original plan. The total excavated quantity was about 13,346 cubic yards more than originally estimated (15,995 cubic yards).

A draft version of this RA site closure report (SWDIV, 2002) was submitted to and reviewed by the parties to the FFA for final concurrence on the effectiveness of the site remediation. A copy of the review comments is provided in Appendix F, which serves as the final inspection and certification of the RA at IR Site 2A.

6.0 Operation and Maintenance Activities

IR Site 2A has been remediated in accordance with the RD/RA work plan to meet the cleanup standards stipulated in the OU3 ROD. The site no longer poses threats to human health or the surrounding environment. Subsequently, five-year reviews are not required. The site grade was restored and site vegetation was reintroduced during July and October 2000, respectively. No specific long-term postclosure operation, monitoring, or maintenance is needed.

6-1

7.0 Summary of Project Costs

The project cost was estimated to be \$0.7 million in the OU3 ROD. The actual cost was about \$1,098,000. The breakdown of the actual cost is as follows:

Remedial Action Activities	Total Cost
RD/RA work plan, study, engineering planning	\$65,000
Site preparation and clearing	\$20,000
Remedial excavation	\$196,000
Transportation of excavated wastes	\$282,000
Disposal of excavated wastes at CAMU	\$91,000
Confirmation sampling and survey control	\$85,000
Site backfill	\$147,000
Site revegetation	\$30,000
Construction engineering monitoring	\$50,000
Construction management	\$80,000
Miscellaneous costs (5%)	\$52,000
Subtotal	\$1,098,000

It should be noted that the above total cost does not include the cost associated with the closure of the CAMU at IR Site 7.

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RWQCB, see California Regional Water Quality Control Board

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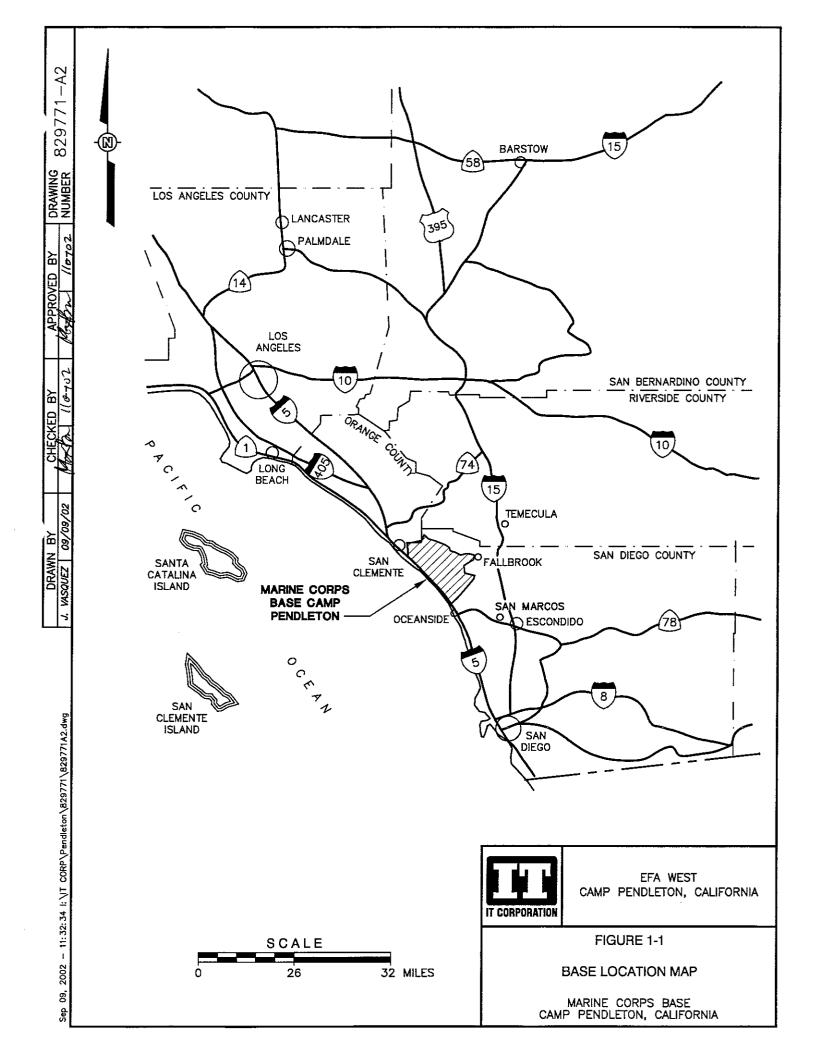
SWDIV, see Southwest Division Naval Facilities Engineering Command.

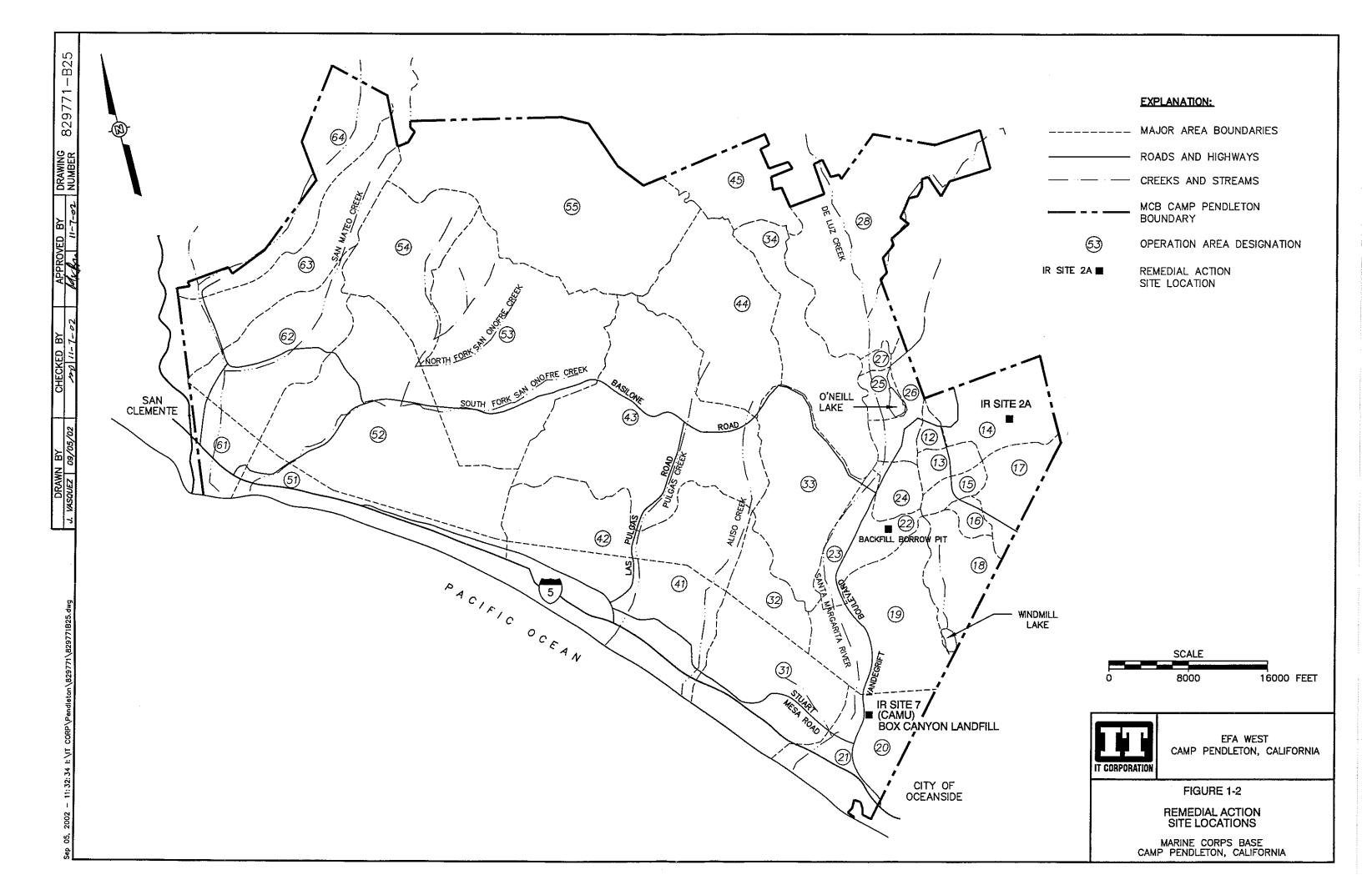
EPA, see U.S. Environmental Protection Agency.

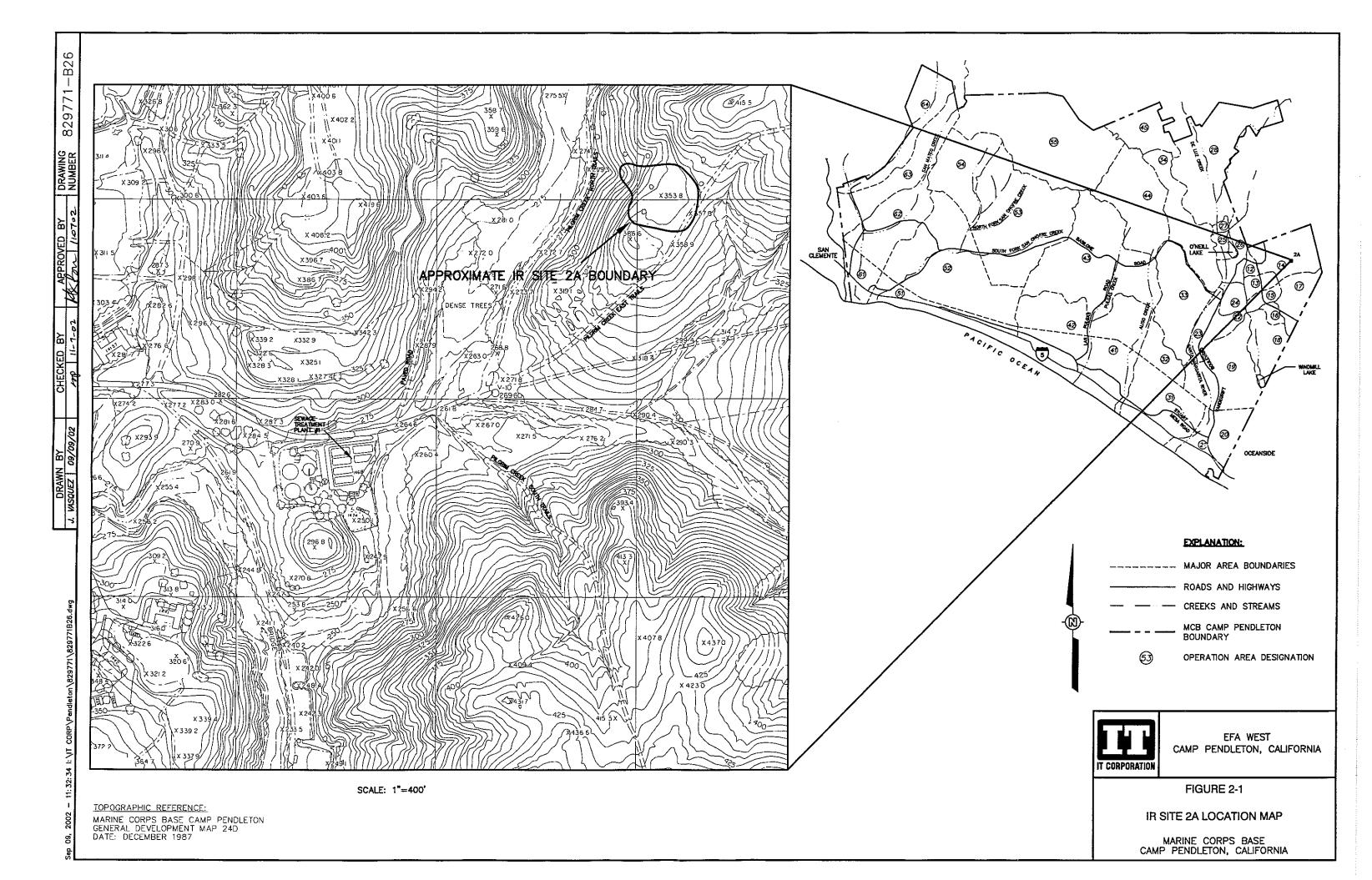
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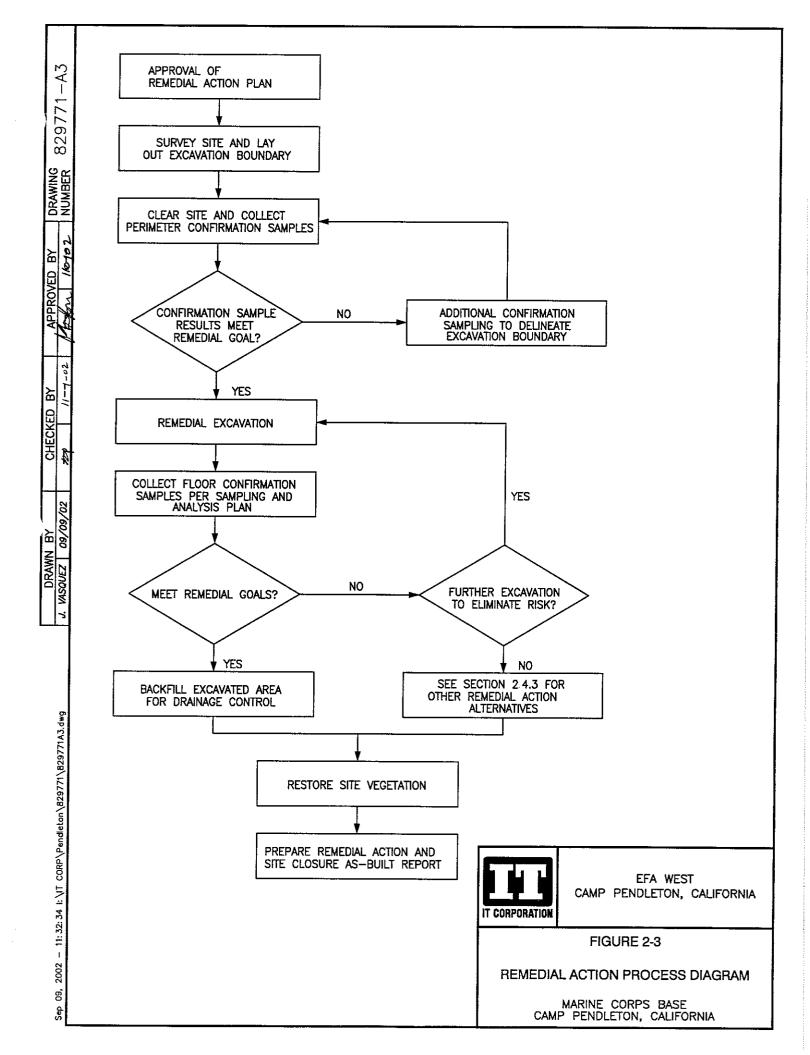
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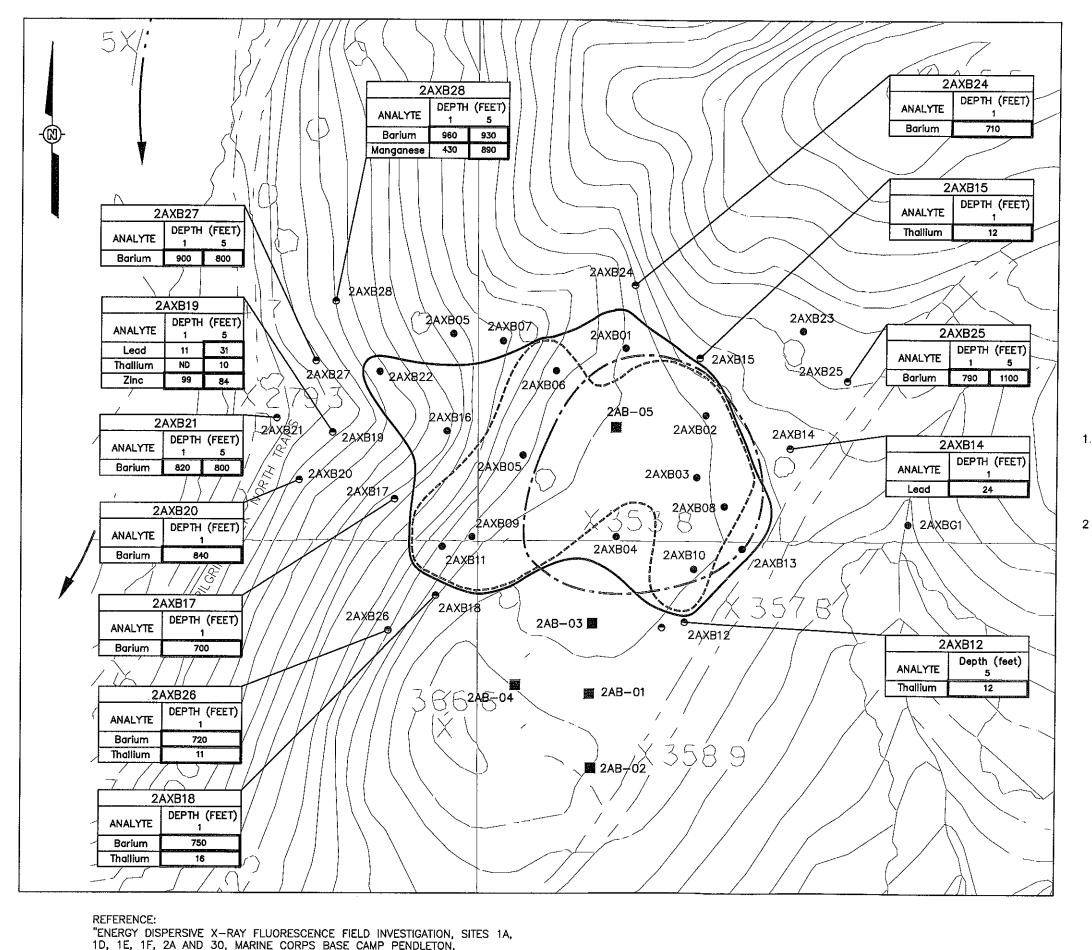
FIGURES











82977

CALIFORNIA", PREPARED BY IT CORP

EXPLANATION:

2AXB09 • XRF BORING LOCATION

2AXB28 • XRF BORING WITH SLIGHT EXCEEDANCE OF XRF—BASED COMPARISON LEVEL

2AB-02 RI BORING LOCATION

SURFACE—WATER FLOW DIRECTION

SITE BOUNDARY-XRF (SWDIV, 1998b)

ESTIMATED BOUNDARY IN OU3 FS (SWDIV 1998a)

DEBRIS NOTED IN BORING LOGS

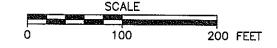
ANALYTE	XRF-BASED COMPARISON LEVEL (mg/kg)	<u>FS_REMEDIAL</u> GOAL (mg/kg)
BARIUM	681	133
LEAD	22	12
MANGANESE	882	783
THALLIUM	1 4	1.4
ZINC	72	163

NOTES:

- 1. CONCENTRATIONS IN BORINGS WHICH SLIGHTLY EXCEEDED XRF-BASED COMPARISON LEVEL BUT WERE EXCLUDED FROM EXTENT OF SITE BOUNDARY ARE SHOWN. ONLY ANALYTES AND DEPTHS WITH EXCEEDANCES ARE SHOWN. BOLDED CELLS DENOTE CONCENTRATIONS THAT EXCEED XRF-BASED COMPARISON LEVEL.
- 2 XRF X-RAY FLUORESCENCE

TOPOGRAPHIC REFERENCE:
MARINE CORPS BASE CAMP PENDLETON
GENERAL DEVELOPMENT MAP 24D

DATE: DECEMBER 1987

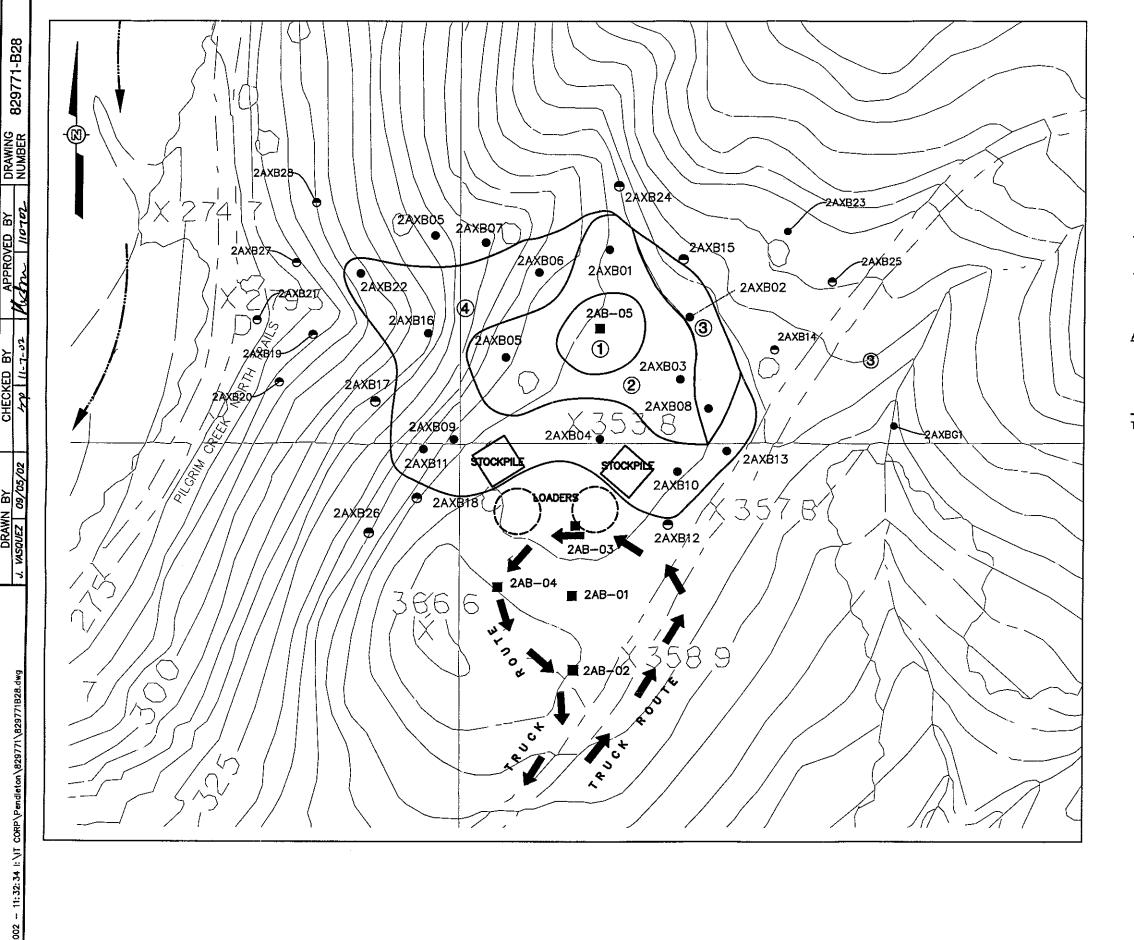




EFA WEST CAMP PENDLETON, CALIFORNIA

FIGURE 2-2

ESTIMATED EXTENT OF CONTAMINATION IR SITE 2A



2AXB09 • XRF BORING LOCATION

2AB-02 ■ RI SOIL BORING LOCATION

2AXB24 S XRF BORING WITH SLIGHT EXCEEDANCE OF XRF—BASED COMPARISON LEVEL

SURFACE-WATER FLOW DIRECTION

EXCAVATION BOUNDARY

TRUCK ROUTE

AREA NO.	AREA (FT.2)	PLANNED EXCAVATION DEPTH (FT)	ESTIMATED VOLUME (CY)
1	6,134	10	2,272
2 .	32,031	5	5,932
3	7,768	7	2,014
4	51,994	3	5,777
TOTAL	97,927		15,995

TOPOGRAPHIC REFERENCE:
MARINE CORPS BASE CAMP PENDLETON
GENERAL DEVELOPMENT MAP 24D.
DATE: DECEMBER 1987

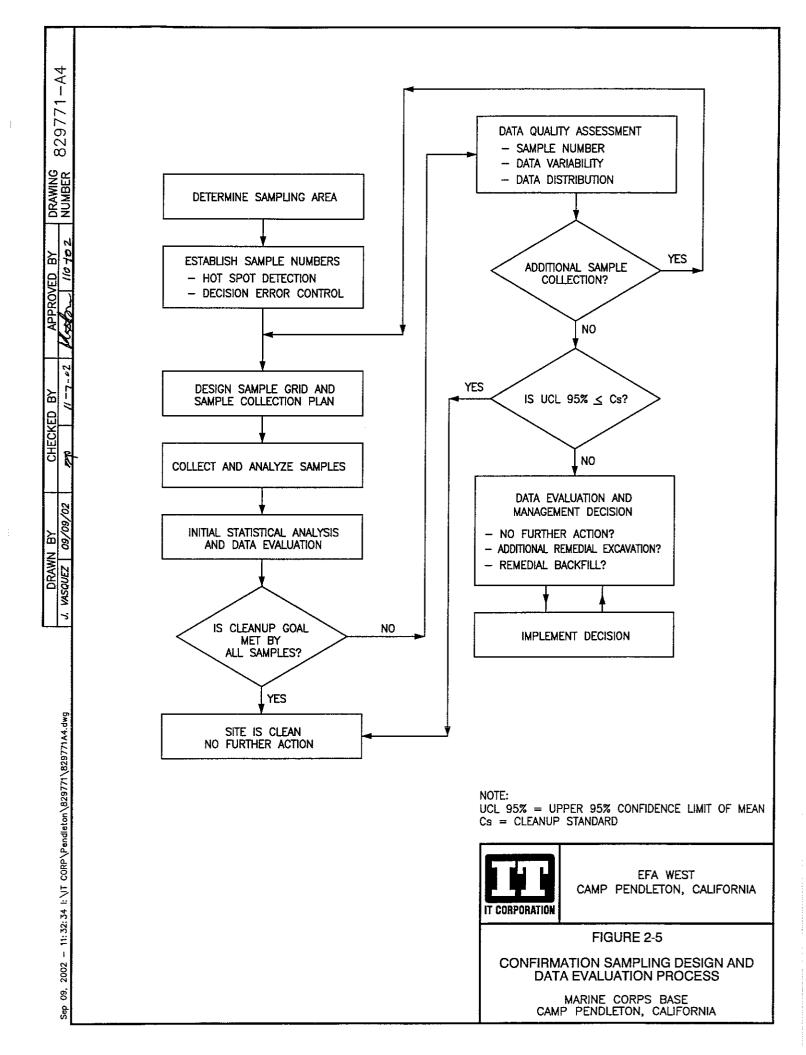


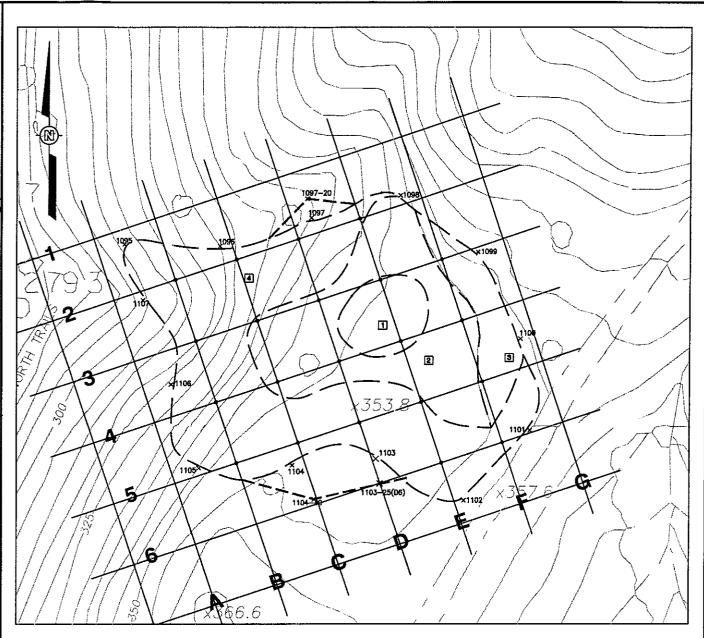


EFA WEST
CAMP PENDLETON, CALIFORNIA

FIGURE 2-4

PLANNED EXCAVATION BOUNDARY IR SITE 2A





REVISED EXCAVATION BOUNDARY



SITE BOUNDARY AND AREA NUMBER PER WORK PLAN

FLOOR CONFIRMATION SAMPLING LOCATION

1133 ×

PERIMETER CONFIRMATION SAMPLE LOCATION

300 PRE EXCAVATION CONTOUR

TOPOGRAPHIC REFERENCE: MARINE CORPS BASE CAMP PENDLETON CENERAL DEVELOPMENT MAPS 24D DATE: DECEMBER 1987

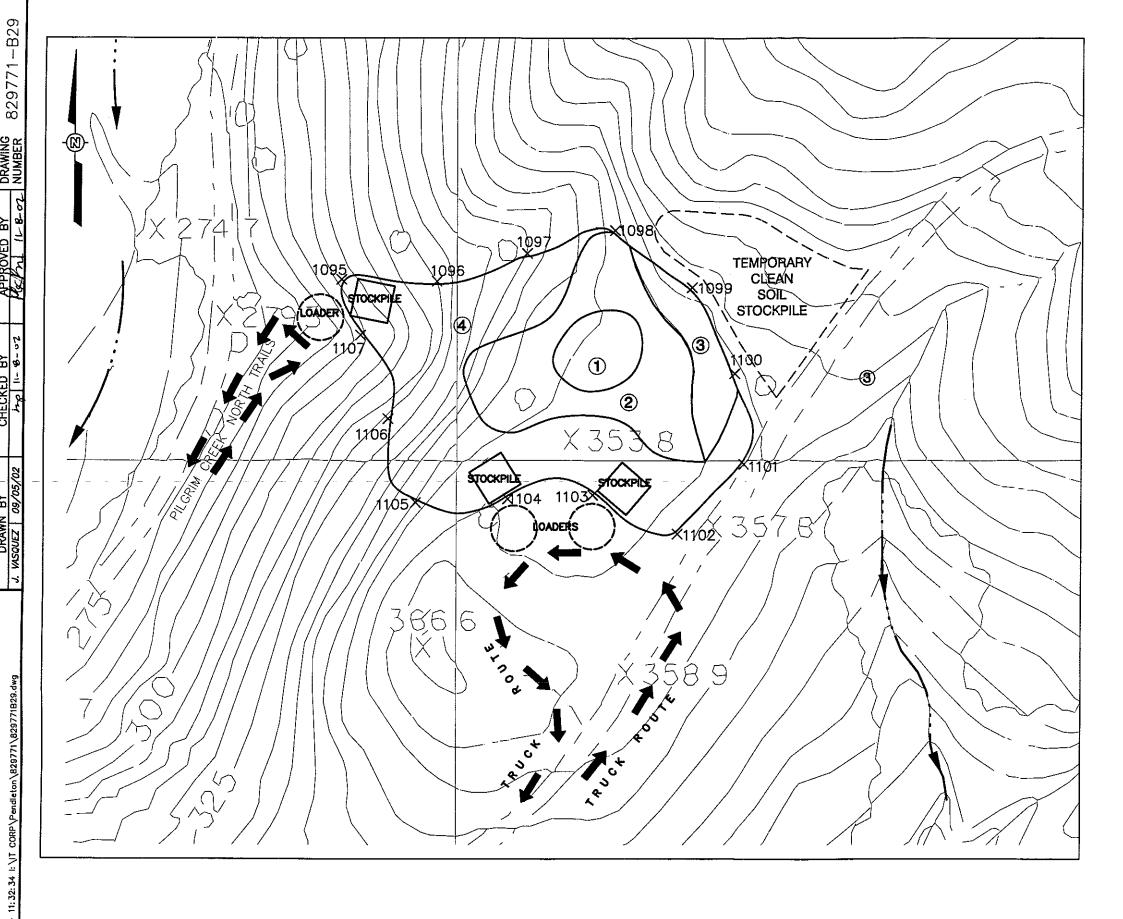




EFA WEST CAMP PENDLETON, CALIFORNIA

FIGURE 3-1

CONFIRMATION SAMPLING PLAN IR SITE 2A



1102 X PERIMETER SAMPLING LOCATION

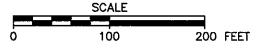
SURFACE—WATER FLOW DIRECTION

EXCAVATION BOUNDARY

TRUCK ROUTE

AREA NO.	AREA (FT. ²)	PLANNED EXCAVATION DEPTH (FT)	ESTIMATED VOLUME (CY)
1	6,134	10	2,272
2	32,031	5	5,932
3	7,768	7	2,014
4	51,994	3	5,777
TOTAL	97,927		15,995

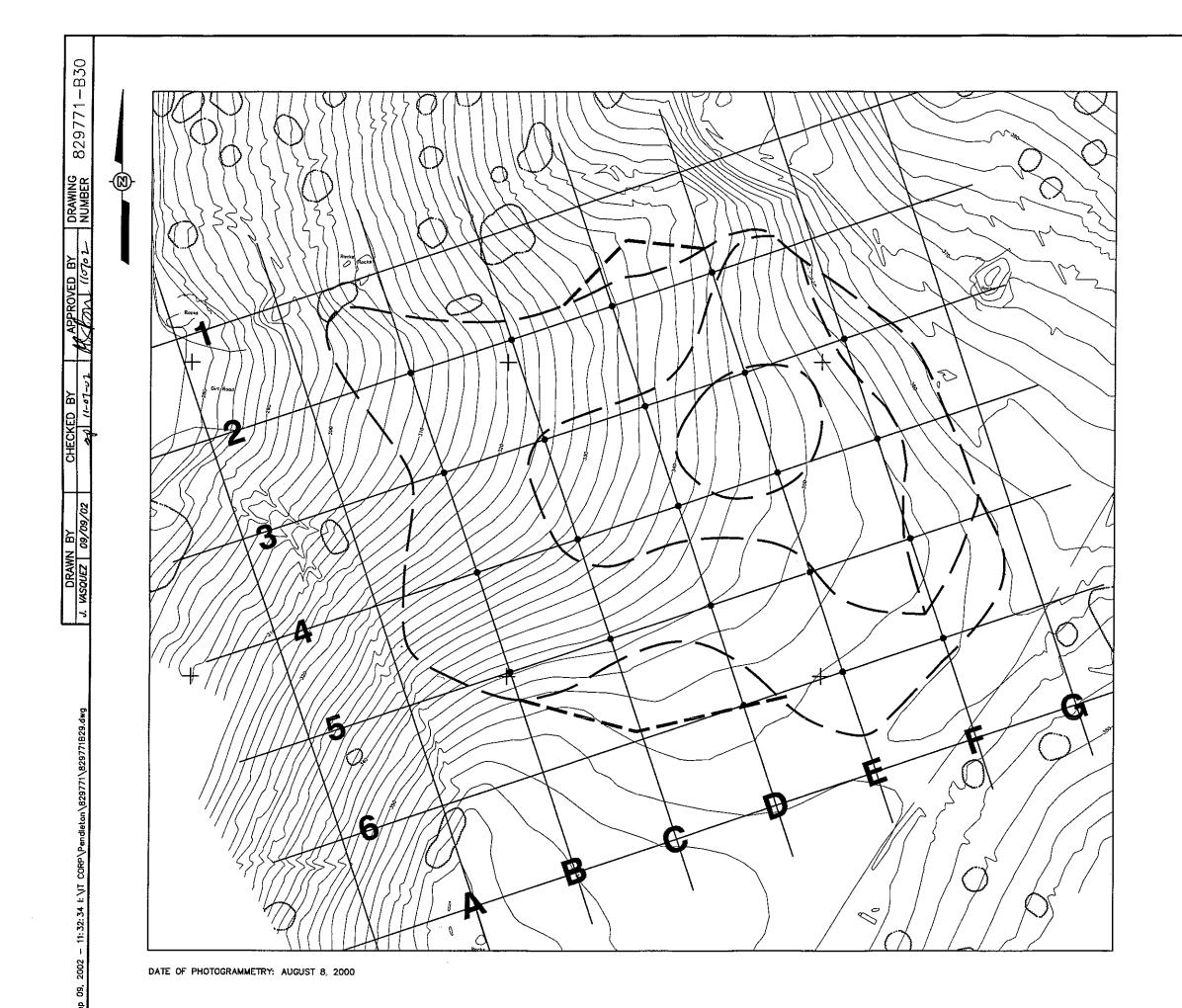
TOPOGRAPHIC REFERENCE:
MARINE CORPS BASE CAMP PENDLETON
GENERAL DEVELOPMENT MAP 24D.
DATE: DECEMBER 1987





EFA WEST CAMP PENDLETON, CALIFORNIA

FIGURE 3-2 SITE PLAN AND PLANNED EXCAVATION BOUNDARY IR SITE 2A



---- REVISED EXCAVATION BOUNDARY

1

SITE BOUNDARY AND AREA NUMBER PER WORK PLAN

FLOOR CONFIRMATION SAMPLING LOCATION

NOTE

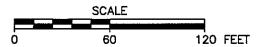
THIS MAP WAS PREPARED USING PHOTOGRAMMETRIC COMPUTER AIDED DRAFTING TECHNIQUES.

IN OPEN, UNOBSTRUCTED AREAS THIS MAP COMPLIES WITH NATIONAL STANDARDS FOR MAP ACCURACY. IN AREAS OF DENSE VEGETATION WHERE THE GROUND IS OBSCURED FROM MEW, CONTOURS MAY DEVIATE FROM CORRECT ELEVATION.

FIELD SURVEY CONTROL BY IT CORPORATION TOPOGRAPHIC MAP PRODUCED BY TOWILL SURVEY INC.

I STATE THAT THIS DATA HAS BEEN PRODUCED BY ME OR UNDER MY DIRECTION IN CONFORMANCE WITH THE REQUIREMENTS OF THE CALIFORNIA LAND SURVEYOR'S ACT (CALIFORNIA BUSINESS AND PROFESSIONS CODE SECTION 8700 ET SEQ.).



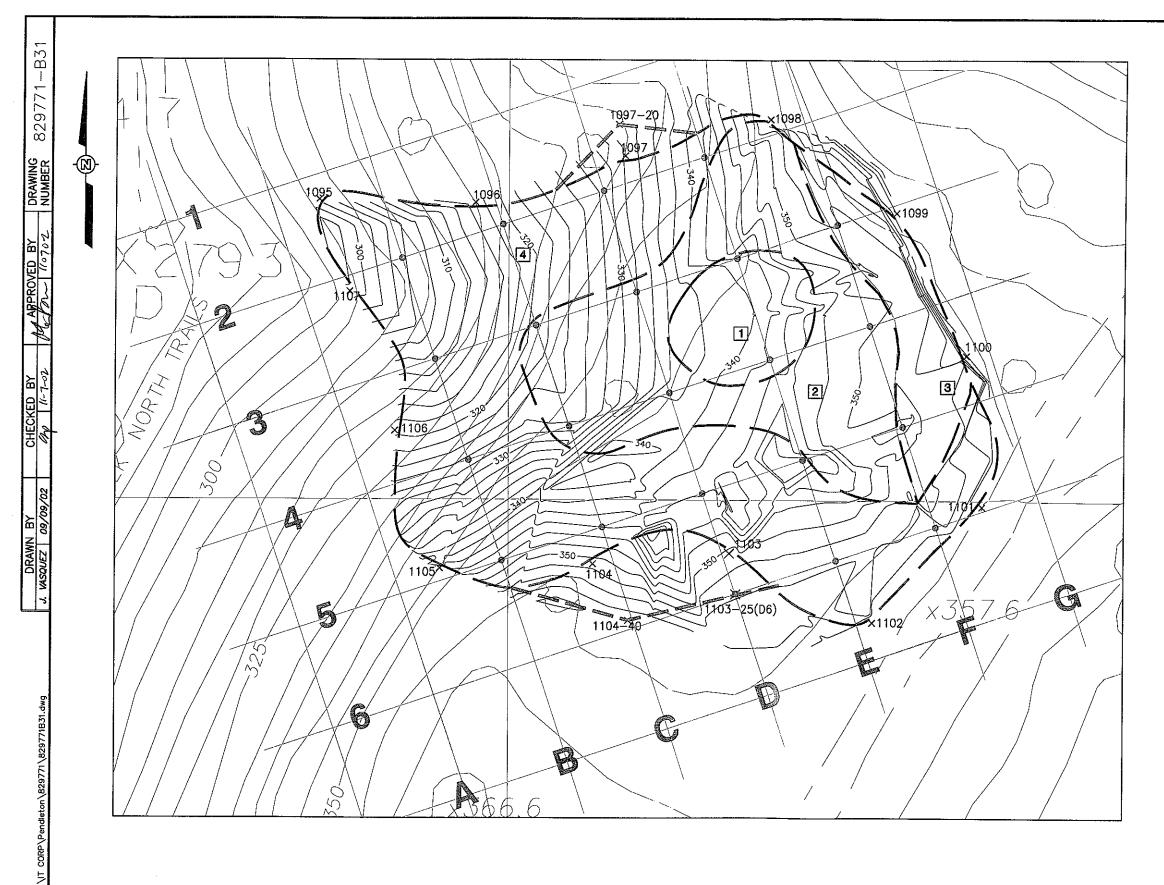




EFA WEST
CAMP PENDLETON, CALIFORNIA

FIGURE 3-3

FINAL SITE GRADE AS-BUILT CONDITIONS IR SITE 2A



--- REVISED EXCAVATION BOUNDARY

SITE BOUNDARY AND AREA NUMBER PER WORK PLAN

FLOOR CONFIRMATION SAMPLING LOCATION

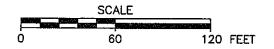
1133 × PERIMETER CONFIRMATION SAMPLE LOCATION

300 — PREEXCAVATION CONTOUR

320— POSTEXCAVATION CONTOUR

TOPOGRAPHIC REFERENCE: MARINE CORPS BASE CAMP PENDLETON GENERAL DEVELOPMENT MAPS 24D. DATE: DECEMBER 1987

POSTEXCAVATION SURVEY DATA BY: CAL VADA SURVEYING INC. DATE: 12-23-1999

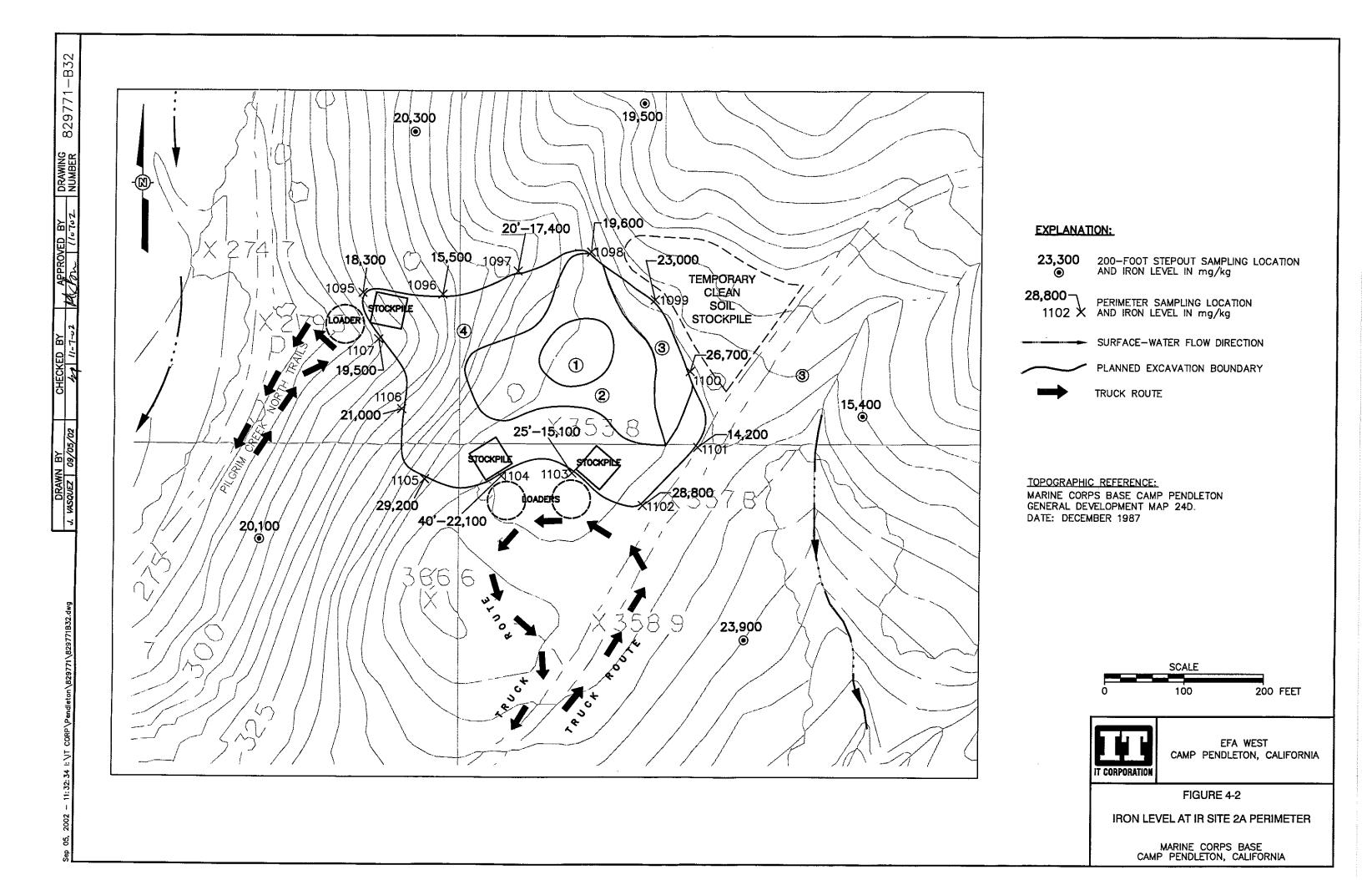




EFA WEST CAMP PENDLETON, CALIFORNIA

FIGURE 4-1

POSTEXCAVATION AS-BUILT CONDITIONS IR SITE 2A



TABLES

Table 2-1
Remediation Standards for Soil at IR Site 2A

	Maximum Concentration in RI/FS ^a	0 to 5	ion Standard, Feet Below Id Surface	5 to 10 F	on Standard, eet Below Surface
COCs	(mg/kg)	(mg/kg)	Basis ^{a,b}	(mg/kg)	Basis ^{a,c}
Antimony	64	8.8	Background	31	PRG
Arsenic	16	16	Background	16	Background
Barium	1,530	133	Background		
Cadmium	44	9	PRG, PLE	9	PRG
Chromium	890	16	Background		
Cobalt	160	13	Background		
Copper	8,790	12	PLE	2,800	PRG
Iron	99,500	20,200	Background		
Lead	2,020	12	PLE	130	PRG
Manganese	345,000	783	PLE	3,200	PRG
Mercury	7.3	0.6	PLE		
Molybdenum	73	7.4	Background		
Silver	120	5	PLE		
Thallium	144	1.4	Background	5.4	PRG
Zìnc	226,000	163	PLE	23,000	PRG

	Maximum Concentration in RI/FS ^a	0 to 5 F	on Standard, eet Below i Surface	5 to 10 Fe	n Standard, eet Below Surface
COCs	(µg/kg)	(µg/kg)	Basis ^{a,b}	(µg/kg)	Basis ^{a,c}
4,4'-DDD	1.9	1.9	PRG	1.9	PRG
4,4'-DDE	2.2	1.3	PRG	1.3	PRG

^a Source. Marine Corps Base Camp Pendleton, California, Record of Decision, Operable Unit 3, Final (SWDIV, 1999a)

COCs - chemicals of concern

mg/kg - milligrams per kilogram

PLE - preliminary limit of exposure

PRG - preliminary remediation goal

RI/FS - remedial investigation/feasibility study

μg/kg – micrograms per kilogram

^b Goal is noted as either PRG, PLE, or background, whichever is the basis for the goal for 0 to 5 feet below ground surface

Goal is noted as either PRG, PLE, or background, whichever is the basis for the goal for 5 to 10 feet below ground surface

⁻ Indicates that compound is not a remediation contaminant of concern at that depth interval

of Initial Darimotor (Wall) Confirmation Compline Doenlie Table 3-1

INICIAL	erimeter	Summary of Initial Perimeter (Wall) Confirmation Sall	nirmadon	Sam	HIII K	es a les												
		Analyte	Antimony	_	Arsenic	Barium	Ε	Cadmium		Chromium	_	Cobalt	ပ	opper	4,4'-DDD	OOC	4,4'-DDE	Œ
		0 to 5 feet	8.8 (B)		16 (B)	133 (B)	€	9 (PRG)		16 (B)		13 (B)	12	12 (PLE)	1.9 (PRG)	RG)	1.3(F	1.3 (PRG)
		5 to 10 feet	31 (PRG)		16 (B)	:		9 (PRG)		ı		1	2,8	300 (B)	1.9 (P	RG)	1.3(F	RG)
		Unit	mg/kg	_	ng/kg	mg/kg	g	mg/kg		mg/kg	'	mg/kg	_	ng/kg	/Brl	ğ	/Bri	'kg
	Sample	Date																
	Depth	Collected																
	1.5	3/29/1999	0.25	0	4	46.8		0.83	∍	5.4		7.5	4,	25	2.1	-	2.1	-
	1.5	3/29/1999	0.25	1	1	43		0.82	<u> </u>	4.4	9	6.9	ις	5.5	2	2	2	Ω
	1.5'	3/29/1999	34.7	X 1.	17.2	X 312	×	14.1	×	87.1	X 23	23.6	X	1160 X	54	×	167	×
	2.5	3/29/1999	0.25	1	6	46.6		0.85	_ 	10	7	7.3	0	0.23	1.7	_	2.1	
	3.5	3/29/1999	0.25	1	6.	106		0.84	5	18.4	×	11.7	4	46	2.1	<u> </u>	2.1	
	3.5	3/29/1999	0.26	0 2	.4	61.1		0.87	5	1.8		16	×	5	2.2	-	2.2	_
	1.5	3/29/1999	0.061	U 1	.5	40.3	_	0.076	_	6.4	_	5	6	9.5	9.0	7	8	×
	1.5	3/29/1999	0.27	U 2	е.	73.3		6.0	n	2.8	_	12	6	9.1	0.5	_	0.7	_
	1.5	3/30/1999	0.26	 N	3	75.8		0.88	Ú	7.5	6	9.6	9	9.9	2.2	-	2.2	1
	1.5	3/30/1999	17	2 2	6	211	X	4.9		32	X 1	13.3	X 5	539 X	_	×		×
	1.5	3/30/1999	0.25	3	.7	99.7		0.84	n	3.1		8	21.1		2.1		2.1	-
	1.5	3/30/1999	0.25	U 2	.3	60.5		0.82		9.9	8	8.2	1	7.9	6.0	-	4.5	×
	1.5	3/30/1999	0.24	7	ις.	75.6	_	0.45	r	2.5	9	6.3	11	11.5	-		0.1	7

_						т		1.	T	1	1			ī	I.	1	1	1
	c:	g					L	×	-	_	_	<u> </u>	↓ _	L	×	┡	┡	╀
Zinc	163 (PLE	23,000 (PRG)	mg/kg	,		30.9	25.9	13200	28.8	30.9	24.2	35.9	64.4	27.1	380	35.4	40.2	148
				Г		5	Э	Э	5	=	∍	∍	╒	5	5	5	⊃	∍
Thallium	1.4 (B)	5.4 (PRG)	mg/kg			0.29	0.29	0.74	0.3	0.29	0.31	0.071	0.31	0.31	0.3	0.29	0.29	0.29
 				\vdash		5	_	×	5	5	5	5	_	5		5	5	5
Silver	5 (PLE)	ı	mg/kg			2.1	2	13	2.1	2.1	2.2	0.51	2.2	2.2	4.6	2.1	2.1	2
Ę				Т		T	Г	Г	5	5	5	5	5	5	5	5	Б	5
Molybdenum	7.4 (B)	:	mg/kg			0.7	0.79	5.8	0.85	0.84	78.0	0.2	6.0	0.88	0.85	0.84	0.82	0.81
	-			Г		Э	Э	×	5	∍	5	_	П	>	-	5	-	⊃
Mercury	0.6 (PLE)	;	mg/kg			0.21	0.2	0.64	0.21	0.21	0.22	0.2	0.22	0.22	0.094	0.21	0.036	0.2
		_						×				-		Т	×			
Manganese	783 (PLE)	3,200 (PRG)	mg/kg			242	226	4860	253	301	27.7	151	377	290	814	229	270	276
								×		5		×			X			
Lead	12 (PLE)	130 (PRG)	mg/kg			2.6	2.3	2070	6.3	1.3	2.6	23.5	8.5	3.3	632	2.4	7.8	2.2
								Χ		Χ	×		Χ	Χ	×	X	×	
<u>rol</u>	20,200 (B)	ı	mg/kg			18,300	15,500	165,000	19,600	23,000	26,700	14,200	28,800	25,600	57,500	29,200	21,000	19,500
Analyte	0 to 5 feet	5 to 10 feet	Unit	Date	Collected	3/29/1999	3/29/1999	3/29/1999	3/29/1999	3/29/1999	3/29/1999	3/29/1999	3/29/1999	3/30/1999	3/30/1999	3/30/1999	3/30/1999	3/30/1999
				Sample	Depth	1.5'	1.5'	1.5	2.5'	3.5	3.5	1.5	1.5'	1.5'	1.5'	1.5'	1.5'	1.5'
	dard ^a			Sample Location	Number	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105	1106	1107
	Cleanup Standard ^a			Sample	Identifier	19739-133	19739-130	19739-128	19739-125	19739-123	19739-121	19739-119	19739-117	19739-144	19739-139	19739-141	19739-135	19739-137

Cleanup Standard a: Cleanup standards are based on background (B), preliminary limit of exposure (PLE), or preliminary remediation goal (PRG)

X - result exceeds the 0 to 5 foot cleanup standard U- not detected above or equal to the stated reporting limit J - estimated value

mg/kg - milligrams per kilogram µg/kg - micrograms per kilogram

Table 3-2 Summary of Floor Confirmation Sampling Results at Planned Excavation Depth

				Analyte	Antimony	Arsenic	Banum	Cadmium	Chromium	Cobalt	Copper	4,4-DDD	4,4'-DDE
Cleanup Sta	indard *			0 to 5 feet	88(B)	16 (B)	133 (B)	9 (PRG)	16 (B)	13 (B)	12 (PLE)	19 (PRG)	1.3 (PRG)
				5 to 10 feet	31 (PRG)	16 (B)	***	9 (PRG)	→	-	2.800 (B)	19 (PRG)	1.3 (PRG)
				Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	μg/kg	μg/kg
Sample		Sample	Sample	Date									
Identifier	Grid Location	Location Number	Depth (Ft)	Collected									
19739-440	B2	2AB2-01	3.5	7/27/1999	<0.35	2.3	47.8	0.26 J	4.4	7.4	31.5 X	0.8	2.1 X
19739-442	B3	2AB3-01	3.5	7/27/1999	<0.35	2.2	47.9	1.10	7.0	7.2	5.6	1.2	0.4
19739-421	B4	2AB4-01	3.5	7/22/1999	16.5 X	3.8	143 X	6.1	63.5 X	7.6	575 X	197.0 X	236 X
19739-438	B5	2AB5-01	3.5	7/27/1999	<0.35	2.2	93	<0.82	7.0	7,3	5.9	<0.23	<0.2
19739-417	C2	2AC2-01	3.5	7/22/1999	47.6 X	14.4	299 X	11.6 X	103 X	23.9 X	1,290 X	70.0 X	130 X
19739-419	C3	2AC3-01	5.5	7/22/1999	12.2 X	5.7	167 X	3.9	35.1 X	9.8	414 X	228.0 X	159 X
19739-446	C4	2AC4-01	5.5	7/27/1999	22.0 X	7.9	224 X	7.8	53.7 X	18.9 X	419 X	22.1 X	39.5 X
19739-444	C5	2AC5-01	3.5	7/27/1999	42.9 X	9.9	375 X	13.7 X	88.6 X	22.3 X	1,150 X	35,1 X	61.3 X
19739-429	D2	2AD2-01	3.5	7/27/1999	51.5 X	16.6 X	388 X	13.2 X	82.9 X	26.0 X	1,750 X	16.9 X	109 X
19739-415	D3 [2AD3-01	5.5	7/22/1999	19.0 X	6.1	242 X	7.0	54.3 X	10.6	868 X	100.0 X	657 X
19739-436	D4	2AD4-01	5.5	7/27/1999	24.8 X	9.6	242 X	7.5	48.2 X	17.7 X	1,490 X	443.0 X	764 X
19739-433	D5	2AD5-01	3.5	7/27/1999	31.3 X	6.3	397 X	14.8 X	93.4 X	15.8 X	1500 X	2010 X	3040 X
19739-363	E2	2AE2-01	3,5	7/20/1999	<0.35	1.4	87.1	<0.82	21.2 X	10.7	2.7	<0.27	0.2
19739-412	E3	2AE3-01	10.5	7/22/1999	<0.36	0.9	47.1	< 0.84	3.9	6.8	8.1	<0.28	<0.12
19739-411	E4	2AE4-01	10.5	7/22/1999	<0.38	2.0	62.4	< 0.9	12.5	10.6	5.3	<0.31	0.4
19739-431	E5	2AE5-01	3.5	7/27/1999	<0.36	1.5	79.5	<0.84	7.9	9,6	7.4	<0.23	<0.2
19739-409	E6	2AE6-01	3.5	7/22/1999	<0,39	1.8	87,1	<0,91	7.0	9.9	4.7	<0.31	0.4
19739-371	F3	2AF3-01	7.5	7/20/1999	<0.35	2.6	42.1	<0.81	6.6	8.9	0.7 J	1.9	2.1 X
19739-365	F4	2AF4-01	5.5	7/20/1999	<0.35	0.8	20.0	<0.83	4.3	4.2	3.6	<0.28	<0.11
19739-367	F5	2AF5-01	7.5	7/20/1999	<0.38	2.1	72.0	<0.9	7.8	14.9 X	7.9	6.1 X	2.6 X
19739-369	F6	2AF6-01	3.5	7/20/1999	<0.38	1.8	75.3	<0.9	3.4	15.6 X	6.9	53.4 X	345 X

	-			Analyte	Iron	Lead	Manganese	Mercury	Molybdenum	Silver	Thallium	Zinc
Cleanup Sta	andard *			0 to 5 feet	20 200 (B)	12 (PLE)	783 (PLE)	06 (PLE)	7 4 (B)	5 (PLE)	14(B)	163 (PLE)
				5 to 10 feet		130 (PRG)	3 200 (PRG)			_	5 4 (PRG)	23,000 (PRG)
ĺ				Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Sample Identifier	Grid Location	Sample Location Number	Sample Depth (ft)	Date Collected								
19739-440	B2	2AB2-01	3.5	7/27/1999	18,600	34.5 X	608	0.06 J	0.8	<2.1	<0.35	224 X
19739-442	B3	2AB3-01	3.5	7/27/1999	18,200	2.7	356	<0.21	0.2 J	<2.1	<0.35	400 X
19739-421	B4	2AB4-01	3.5	7/22/1999	26,800 X	490 X	873 X	0.15 J	1.7	3.9	<0.43	1,590 X
19739-438	B5	2AB5-01	3.5	7/27/1999	19,300	176 X	227	<0.21	0.3 J	<2.1	<0.35	47.9
19739-417	C2	2AC2-01	3.5	7/22/1999	151,000 X	1,630 X	4,280 X	0.76 X	4.1 J	11.5 X	<1.8	5,500 X
19739-419	C3	2AC3-01	5.5	7/22/1999	37,600 X	535 X	1,170 X	0.52	2.0	4.0	<0.36	2,050 X
19739-446	C4	2AC4-01	5.5	7/27/1999	133,000 X	1,060 X	1,430 X	0.25	<4.3	5.5 J	<1.8	3,850 X
19739-444	C5	2AC5-01	3.5	7/27/1999	170,000 X	2,700 X	2,550 X	0.38	2.1 J	28.0 X	<1.8	4,610 X
19739-429	D2	2AD2-01	3.5	7/27/1999	139,000 X	2,390 X	4,420 X	1.10 X	2.9 J	11.7 X	<1.8	5,850 X
19739-415	D3	2AD3-01	5.5	7/22/1999	53,300 X	1,770 X	2,180 X	0.61 X	2.7	5.7 X	<0.39	2,560 X
19739-436	D4	2AD4-01	5,5	7/27/1999	65,800 X	1,350 X	5,390 X	0.19 J	3.6	8.2 X	<0.74	3,480 X
19739-433	D5	2AD5-01	3.5	7/27/1999	13,600	874 X	1310 X	0.21 J	4.8	13.9 X	<0.37	43 30 X
19739-363	E2	2AE2-01	3.5	7/20/1999	19,200	3.0	253	<0.20	0.7 J	<2.0	<0.35	29.8
19739-412	E3	2AE3-01	10.5	7/22/1999	15,400	1.4	287	<0.21	<0.84	<2.1	<0.36	29.7
19739-411	E4	2AE4-01_	10.5	7/22/1999	23,400 X	6,2	247	<0.23	0.2 J	<2.3	<0.38	34.7
19739-431	E5	2AE5-01	3,5	7/27/1999	19,200	8,1	375	0.028 J	<0.84	<2.1	<0.36	33,1
19739-409	E6	2AE6-01	3.5	7/22/1999	24,800 X	3.0	309	0.03 J	<0.91	<2.3	<0.39	33.0
19739-371	F3	2AF3-01	7.5	7/20/1999	20,800 X	2.9	368	<0.2	1.2	<2	<0.35	44.1
19739-365	F4	2AF4-01	5.5	7/20/1999	8,840	2.1	84.3	<0.21	<0.83	<2.1	<0,35	10.9
19739-367	F5	2AF5-01	7.5	7/20/1999	31,100 X	2.8	353	<0.23	<0.9	<2.3	<0.38	35.1
19739-369	F6	2AF6-01	3.5	7/20/1999	37,900 X	1.3 J	275	<0.23	<0.9	<2.3	<0.38	53.7

Cleanup standard *. Cleanup standards are based on background (B), preliminary limit of exposure (PLE), or preliminary remediation goal (PRG)
X - result exceeds the 0 to 5 foot cleanup standard
J - estimated value

mg/kg - milligrams per kilogram

µg/kg

μg/kg - micrograms per kilogram

Table 3-3 Summary of Floor Confirmation Sampling Results at Overexcavation Depth

			***	Analyte	Antimony		Arsenic		Barium		Cadmium	1	Chromiur	п	Cobalt		Copper		4,4'-DD	D	4,4'-DDI	<u> </u>
Cleanup Sta	andard "			0 to 5 feet	8.8 (B)		16 (B)		133 (B)		9 (PRG)		16 (B)		13 (B)		12 (PLE	}	1.9 (PR	G)	13 (PRG	3)
				5 to 10 feet	31 (PRG)	16 (B)				9 (PRG)		_		_		2,800 (B)	19 (PR	G)	13 (PRG	3)
				Unit	mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		μg/kg		μg/kg	
Sample Identifier	Grid Location	Sample Location Number	Sample Depth (Ft)	Date Collected																		
19739-441	B2	2AB2-02	5.0	7/27/1999	0.11		2.3		34.7		80.0		3.7		6.0		44.3	Х	0.3		1.2	Ш
19739-442	B3	2AB3-01	3.5	7/27/1999	<0.35		2.2		47.9		1.10		7.0		7.2		5.6	L_	1.2		0.4	ш
19739-736	B4	2AB4-03	11,4	9/24/1999	0.43		2.5		47.0		0.2	J	6.2		7.5		19.2	Х	1.1	_	1.1	ш
19739-438	B5	2AB5-01	3.5	7/27/1999	<0.35		2.2	L.	93.0		<0.82		7.0		7.3		5.9	_	<0.23	L	<0.2	ш
19739-746	C2	2AC2-05	5.1	9/24/1999	18.90	Χ	10.8		157.0	Х	5.9		56.9	X	16.0	X	733.0	Х	26.0	X	62.2	Х
19739-742	C3	2AC3-05	10.9	9/24/1999	7.60	-	3.8		81.9		6.2		14.6	Ш	9.6		142.0	Х	6.7	Х	14.6	χ
19739-749	C4	2AC4-05	24.8	9/24/1999	<0.27		2.7		37.5	Ĺ	< 0.83	t	5.2		8.8		2.0	J	<0.28		<0.11	
19739-744	C5	2AC5-03	10.1	9/24/1999	1.10		2.8		65.5	_	1.2		10,1	Ш	8,4		64.8	Х	10.0	X	12.8	X.
19739-574	D2	2AD2-03	10.4	8/23/1999	<0.59		2.3		133		0.36	J	37.7	Х	14	X	4.9		<0.29	L	0.21	
19739-576	D3	2AD3-05	13.9	8/23/1999	< 0.61		2.5		43.7		<0.87	Ш	7.4		7.0		3.0		<0.29		<0.12	
19739-578	D4	2AD4-05	14.8	8/23/1999	<0.62		1.7		59.5		<0.89		6.8	Ш	7,8	Ш	4.5		<0.3		<0.12	Ш
19739-739	D5	2AD5-05	10.2	9/24/1999	0.39	L	3.9	L	79.2	L	0.1	J	11.9	Ш	8.9	Ш	11.4	_	1.7	<u> </u>	3.3	Х
19739-363	E2	2AE2-01	3.5	7/20/1999	<0.35		1.4		87.1		<0.82		21.2	Х	10.7		2.7		<0.27		0.2	ш
19739-412	E3	2AE3-01	10.5	7/22/1999	< 0.36		0.9	J	47.1		<0.84		3.9		6.8		8.1	<u></u>	<0.28		<0.12	Ш
19739-411	E4	2AE4-01	10.5	7/22/1999	<0.38		2.0		62.4		<0.9		12.5		10.6	Ш	5.3	L	<0.31		0.4	Ш
19739-431	E5	2AE5-01	3.5	7/27/1999	<0.36		1.5		79.5		<0.84		7.9		9.6		7.4	L	<0.23		<0.2	
19739-409	E6	2AE6-01	3.5	7/22/1999	<0.39		1.8		87.1		<0.91		7.0		9.9	Ш	4.7		<0.31		0.4	
19739-371	F3	2AF3-01	7.5	7/20/1999	<0.35		2.6		42.1		<0.81		6.6		8.9		0.7	J	1.9		2.1	Х
19739-365	F4	2AF4-01	5.5	7/20/1999	<0.35		0.8	7	20.0		<0.83		4.3	Ш	4.2	Ш	3.6		<0.28		<0.11	
19739-519	F5	2AF5-03	9.8	8/12/1999	<0.28		0.94	J	59.6		<0.85		7.7	Ш	16.1	Х	11.9		<2.1		<2.1	Ш
19739-369	F6	2AF6-01	3.5	7/20/1999	<0.38		1.8		75.3		<0.9		3.4	\Box	15.6	X	6.9		53.4	ΙΧ.	345	Х

				Analyte	ìron		Lead		Manganes	е	Mercury		Moiybdenu	TI.	Silver		Thallium		Zinc	
Cleanup Sta	andard *			0 to 5 feet	20 200 (8)	12 (PLE)		783 (PLE)	0.6 (PLE)	}	7 4 (B)		5 (PLE)		14(B)		163 (PLE	. =)
				5 to 10 feet	_ `		130 (PRG		3 200 (PR	G)	- '				-		5 4 (PRG)		23,000 (PA	₹G)
				Unit	mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg∕kg	
Sample Identifier	Grid Location	Sample Location Number	Sample Depth (ft)	Date Collected																
19739-441	B2	2AB2-02	5.0	7/27/1999	18,100		25.1	Х	272		0.21	L	0.5		0.5		0.10		113.0	
19739-442	B3	2AB3-01	3.5	7/27/1999	18,200		2.7		356		<0.21		0.2	J	<2.1		<0.35		400	Х
19739-736	B4	2AB4-03	11.4	9/24/1999	15,200		21.6	χ	185		<0.21		0.4	J	<2.1		<0.36		78.1	<u> </u>
19739-438	B5	2AB5-01	3.5	7/27/1999	19,300		176.0	χ	227		<0,21		0.3	7	<2.1		<0.35		47.9	
19739-746	C2	2AC2-05	5.1	9/24/1999	72,400	X	1,050	Х	2,010	X	0.44		3.9		7.3	X	0.87		2,570	Х
19739-742	C3	2AC3-05	10.9	9/24/1999	26,200	Х	148	Х	1,140	Х	0.18	J	0.4	~	1.4	J	<0.36		1,600	X
19739-749	C4	2AC4-05	24.8	9/24/1999	20,800	Χ	1.6		344		<0.21		<0.83		<2.1	Ĺ	<0.35		26	<u></u>
19739-744	C5	2AC5-03	10.1	9/24/1999	20,300	Χ	37.9	Χ	1,010	Х	0.05	J	0.5	,	0.3	7	<0.35		821	Х
19739-574	D2	2AD2-03	10.4	8/23/1999	23,300	Х	1.9		257		<0.21		< 0.85		<2.1		<0.36		55.1	لــــــــا
19739-576	D3	2AD3-05	13.9	8/23/1999	17,200		1.2	j	268		<0.22		<0.87		<2.2		<0.37	\perp	22.6	
19739-578	D4	2AD4-05	14,8	8/23/1999	14,500		1.4		190		<0.22		< 0.89		<2.2		<0,38		18.5	ш
19739-739	D5	2AD5-05	10.2	9/24/1999	27,600	Х	8.0		218		<0.22		<0.88		<2.2		<0.37		66.5	
19739-363	E2	2AE2-01	3.5	7/20/1999	19,200		3.0		253		<0.20		0.7	J	<2.0		<0.35		29.8	ш
19739-412	E3	2AE3-01	10.5	7/22/1999	15,400	L	1.4		287		<0.21		<0.84		<2.1	Ш	<0.36		29.7	
19739-411	E4	2AE4-01	10.5	7/22/1999	23,400	Х	6.2		247		<0.23	L	0.2	J	<2.3	Ш	<0.38	_	34.7	
19739-431	E5	2AE5-01	3.5	7/27/1999	19,200		8.1		375		0.028	J	<0.84		<2.1		<0.36	_	33.1	ш
19739-409	E6	2AE6-01	3.5	7/22/1999	24,800	Х	3.0		309		0.03	J	<0.91		<2.3		<0.39		33.0	ш
19739-371	F3	2AF3-01	7.5	7/20/1999	20,800	Х	2.9		368		<0.2		1.2		<2	Ш	<0.35	_	44.1	ш
19739-365	F4	2AF4-01	5.5	7/20/1999	8,840		2,1		84.3		<0.21		<0.83		<2.1		<0.35	_	10.9	ш
19739-519	F5	2AF5-03	9.8	8/12/1999	30,200	Х	2		211		0.017	7	<0.85		<2.1	L	<0,36	1	40.3	ш
19739-369	F6	2AF6-01	3.5	7/20/1999	37,900	Х	1.3	5	275		< 0.23		<0.9		<2.3		<0.38		53.7	['

Cleanup Standard * - Cleanup standards are based on background (B) preliminary limit of exposure (PLE) or preliminary remediation goals (PRG) X - result exceeds the 0 to 5 foot cleanup standard J - estimated value mg/kg - militigrams per kilogram

µg/kg - militigrams per kilogram

Table 3-4
Summary of Daily Production in Waste Transportation

			Volume		
	Number of	Number of	Hauled to	Accum Total	
Date	Trucks	Loads	Site 7 (yd ³)	Hauled (yd ³)	Comments
07/06/99		•			Start of remedial excavation at Site 2A
07/12/99	5	26	338	338	Began transporting excavated soil
07/13/99	5	31	403	741	
07/14/99	10	54	702	1,443	
07/15/99	10	61	793	2,236	
07/16/99	10	60	780	3,016	
07/19/99	10	57	741	3,757	
07/20/99	10	67	871	4,628	
07/21/99	18	108	1,404	6,032	
07/22/99	19	131	1,703	7,735	
07/23/99	19	128	1,664	9,399	
07/26/99	21	123	1,599	10,998	
07/27/99	15	95	1,235	12,233	
07/28/99	14	63	819	13,052	
07/29/99	11	59	767	13,819	
07/30/99	3	8	104	13,923	
07/30/99	2	2	26		Green waste hauled to Las Pulgas landfill
08/03/99					Start of overexcavation
08/10/99	20	95	1,235	15,158	Began transporting overexcavation soil
08/16/99	9	55	715	15,873	
08/17/99	10	63	819	16,692	
08/18/99	15	84	1,092	17,784	
08/19/99	15	99	1,287	19,071	
08/20/99	14	88	1,144	20,215	
08/23/99	14	87	1,131	21,346	
08/24/99	14	78	1,014	22,360	
08/25/99	16	88	1,144	23,504	
08/26/99	9	38	494	23,998	
08/27/99	10	33	429	24,427	
09/16/99	5	22	286	24,713	
09/20/99	7	43	559	25,272	
09/21/99	3	14	182	25,454	
09/23/99	9	39	507	25,961	
09/24/99	4	11	143	26,104	Completion of overexcavation
10/20/99	9	39	507	26,611	Hot spot excavation
10/21/99	5	8	104	26,715	
11/03/99	9	18	234	26,949	
11/04/99	6	42	546	27,495	
11/08/99	12	62	806	28,301	
11/09/99	4	18	234	28,535	
11/11/99	6	36	468	29,003	
11/12/99	6	26	338	29,341	Final excavation hauling completed

Estimated Volume Hauled to Site 7: 29 341 yd³ Estimated Total Volume per Work Plan: 15,995 yd³

Overexcavation Total: 13 346 yd³

Actual Number of Loads: 2.257 loads
Estimated Number of Loads: 1.230 loads

(assume 13 in-place cubic yards per load using expansion of 1 2)

Accum - accumulative yd ³ - cubic yard

Table 4-1 Summary of Final Sampling Depth

						Sample		
		Sample	Planned	Pre-excav.	Sample	Depth	Actual	
Sample		Location	Excav.	Elevation	Elevation	Below PED	Sample	Date
ldentifier	Grid Location	Number	Depth (feet)	(feet)	(feet)	(feet)	Depth (feet)	Collected
19739-837	B2	2AB2-03	3	309.6	304.2	2.4	5.4	10/21/1999
19739-442	B3	2AB3-01	3	312.8	309.3	0.5	3.5	7/27/1999
19739-736	B4	2AB4-03	3	336.0	324.6	8.4	11.4	9/24/1999
19739-439	B5	2AB5-02	3	351.6	346.6	2.0	5.0	7/27/1999
19739-835	C2	2AC2-07	3	326.6	318.1	5.5	8.5	10/21/1999
19739-831	C3	2AC3-07	5	336.4	319.1	12.3	17.3	10/21/1999
19739-749	C4	2AC4-05	5	350.4	325.6	19.8	24.8	9/24/1999
19739-745	C5	2AC5-04	3	353.2	341.6	8.6	11.6	9/24/1999
19739-574	D2	2AD2-03	3	338.6	328.2	7.4	10.4	8/23/1999
19739-576	D3	2AD3-05	5	346.3	332.4	8.9	13.9	8/23/1999
19739-578	D4	2AD4-05	5	352.1	337.3	9.8	14.8	8/23/1999
19739-739	D5	2AD5-05	3	353.7	343.5	7.2	10.2	9/24/1999
19739-942	D6	2AD6-03	0	NA	NA	NA	5.5	11/15/1999
19739-363	E2	2AE2-01	3	346.5	343.0	0.5	3.5	7/20/1999
19739-412	E3	2AE3-01	10	351.9	341.4	0.5	10.5	7/22/1999
19739-411	E4	2AE4-01	10	352.6	342.1	0.5	10.5	7/22/1999
19739-800	E5	2AE5-03	5	355.2	340.2	10.0	15	10/13/1999
19739-409	E6	2AE6-01	3	355.6	352.1	0.5	3.5	7/22/1999
19739-371	F3	2AF3-01	7	358.7	353.2	-1.5 ^a	5.5	7/20/1999
19739-365	F4	2AF4-01	5	356.8	351.3	0.5	5.5	7/20/1999
19739-519	F5	2AF5-03	7	356.1	346.3	2.8	9.8	8/12/1999
19739-370	F6	2AF6-02	3	356.8	351.8	2.0	5.0	7/20/1999

Average Depth (feet)

4.41

9.60

See Figure 3-2 for illustration of the planned excavation depth.

EXCAV - excavation NA - not available

PED - planned excavation depth

^a undistrubed bedrock layer exposed

Table 4-2 Summary of Final Perimeter (Wall) Confirmation Sampling Results

								_												
			Analyte	Antimony	']	Arsenic	Barium		Cadmiur		Chromiu		Cobalt		Copper		4,4'-DDI		4,4'-DD	
Cleanup Star	ndard		0 to 5 feet	8.8 (B)	- 1	16 (B)	133 (B)		9 (PRG)		16 (B)		13 (B)		12 (PLE)	1 9 (PR))	13 (PR	G)
			5 to 10 feet	31 (PRG)	1	16 (B)	-		9 (PRG)	۱ ا	-		-		2,800 (B)	19 (PRO	j)	13 (PR	G)
			Unit	mg/kg		mg/kg	mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		μg/kg		μg/kg	
	Sample																			
Sample	Location	Sample	Date										i				1	I		
Identifier	Number	Depth	Collected																	- 1
19739-133	1095	1.5'	3/29/1999	0.25	U	2.4	46.8		0.054	Ü	5.4		7.5		5	\perp	0.3	U	0.12	U
19739-130	1096	1.5'	3/29/1999	0.25	[v[1.7	43		0.053	U	4.4	L.	6.9		5.5		0.27	U	0.11	U
19731-314	1097-20	1.5'	7/6/1999	0.45	U	2.4	39.8		0.045	U	16.5	Х	6.9		4.7		0.27	U	0.22	J
19739-125	1098	2.5'	3/29/1999	0.25	U	1.9	46.6		0.055	U	10		7.3		0.23	7	0.28	U	0.12	U
19739-123	1099	3.5'	3/29/1999	0.25	U	1.9	106		0.054	U	18.4	X	11.7	Γ	4.6		0.27] U [0.11	Ū
19739-121	1100	3.5'	3/29/1999	0.26	U	2.4	61.1		0.057	U	8.1	1	16	ĺΧ	- 5		0.29	U	0.12	U
19739-119	1101	1.5'	3/29/1999	0.061	U	1.5	40.3		0.076	U	6.4		5		9.5		0,6	J	3	Х
19739-117	1102	1.5'	3/29/1999	0.27	U	2.3	73.3		0.058	U	2.8	L	12		9.1		0.5	J	0.7	J
19739-942	1103-25	5.5	11/15/1999	0.58	U	1.4	37.4		0.83	U	4.1	Т	5.8	П	2.4		0.84	IJ	0.2	IJ
19739-423	1104-40	1.5'	7/22/1999	0.57		1.6	71.3		0.16	IJ	6.9	Ι	8.9		13.3	Х	0.29	U	1.3	IJ
19739-141	1105	1,5'	3/30/1999	0.25	V	3.7	99.7		0.055	U	3.1		8		21,1	Х	0.28	U	0,11	U
19739-135	1106	1.5'	3/30/1999	0.25	U	2.3	60.5		0.054	U	6.6		8.2		7.9		0.9	J	4.5	X
19739-137	1107	1.5	3/30/1999	0.24	Ü	7.5	75.6		0.45	J	2.5		6.3		11.5		1	J	0.1	J
			Average	0 30		2 54	61 65		0 15		7.32		8 50		7.68		0 47		0.82	
Standard Deviation			_	0.14		1.60	22.65		0.23		5.00		3.04		5.42		0.27		1.38	
Sample Number				13		13	13		13		13		13		13		13		13	
	Stud		bution Value	1 782		1 782	1.782		1 782		1.782		1 782		1.782		1 782		1.782	
			UCL _{95%}	0.37		3.33	72.84		0.27		9.80		10.00		10 36		0 60		1.50	Х

•		•	Analyte	Iron		Lead		Manganes	е	Mercury	'	Molybdenu	m	Silver		Thalliur	n	Zinc	
leanup Star	idard *		0 to 5 feet	20 200 (B)	12 (PLE)		783 (PLE	}	0.6 (PLE)	74(B)		5 (PLE)		1 4 (B) 5 4 (PRG)		163 (PLE) 23 000 (PRG)	
			5 to 10 feet	- '		130 (PRG	i)	3 200 (PRO	3)			-		_					
			Unit	mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg	
	Sample												П						
Sample	Location	Sample	Date		- 1					l			- 1						
Identifier	Number	Depth	Collected																
19739-133	1095	1.5'	3/29/1999	18,300	Ш	2.6		242	<u>i </u>	0.051	U	0,7	U	0.066	υ	0.29	U	30.9	Ι
19739-130	1096	1.5'	3/29/1999	15,500	П	2.3		226		0.05	U	0.79	U	0.065	U	0.29	υ	25.9	
9731-314	1097-20	1.5'	7/6/1999	17,400		2.3		207	L	0.062	J	1.1		0.19	U	0.41	U	25.4	
19739-125	1098	2.5	3/29/1999	19,600	П	6.3		253		0.052	U	0.1	U	0.068	U	0.3	U	28.8	\perp
19739-123	1099	3.5'	3/29/1999	23,000	X	1.3	J	301	Ι	0.051	U	0.1	U	0.067	U	0.29	Ü	30.9	T
19739-121	1100	3.5'	3/29/1999	26,700	X	2.6		277	Γ	0.053	U	0.1	U	0.07	U	0.31	U	24.2	L
19739-119	1101	1.5'	3/29/1999	14,200	П	23.5	Х	151	Ι.	0.05	U	0.024	Įΰ	0.016	U	0.071	U	35,9	Ţ
19739-117	1102	1.5'	3/29/1999	28,800	X	8.5		377		0.2	J	0,11	U	0.072	U	0.31	U	64.4	Ι.
19739-942	1103-25	5.5'	11/15/1999	15100	П	1.7		119		0.082	IJ	0.83	Ū	2.1	U	0.35	U	23.3	Т
19739-423	1104-40	1.5'	7/22/1999	22,100	X	7	Г	324		0.075	U	0.45	J	0.2	U	0.43	U	42.4	Т
19739-141	1105	1.51	3/30/1999	29,200	X	2.4	П	229		0.051	U	0.1	U	0.067	U	0.29	U	35.4	
19739-135	1106	1.5'	3/30/1999	21,000	X	7.8		270		0.036	J	0.099	U	0.066	U	0.29	U	40.2	
19739-137	1107	1.5'	3/30/1999	19,500		2.2		276		0.05	U	0.098	U	0.065	U	0.29	U	148	
			Average	20800		5 42		250.15		0 07		0 35		0 24		0 30		42 75	
		Standa	rd Deviation	5008 49		5.99		68.26		0.04		0.37		0.56		0.08		33.46	
	Sample Number					13		13		13		13		13		13		13	

1782

283.89

UCL_{95%} 23275.39 X 8.39 Cleanup Standard *. Cleanup standards are based on background (B) preliminary limit of exposure (PLE), or the preliminary remediation goals (PRG)

1 782

Student's t Distribution Value 1 782

UCL 95% - upper 95-percent confidence limit

1782

0.09

1 782

0 54

1.782

0.52

1 782

0.34

1 782

59.28

mg/kg - milligrams per kilogram

μg/kg - micrograms per kilogram

X - result exceeds the 0 to 5 foot cleanup standard

 $^{{\}it U}$ - not detected above or equal to the stated reporting limit

J - estimated value

Table 4-3 **Summary of Final Floor Confirmation Sampling Results**

			Analyte	Antimony	Arsenic	Barium	Cadmium	Chromium	Cobalt	Соррег	4,4'-DDD	4,4'-DDE
Cleanup Stan	dard "		0 to 5 feet	8.8 (B)	16 (B)	133 (B)	9 (PRG)	16 (B)	13 (B)	12 (PLE)	19 (PRG)	13 (PRG)
			5 to 10 feet	31 (PRG)	16 (B)		9 (PRG)	-		2 800 (B)	1 9 (PRG)	13 (PRG)
			Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	μg/kg	μg/kg
	Sample											
Sample	Location	Sample	Date									
Identifier	Number	Depth (feet)	Collected			i						
19739-837	2AB2-03	5.4	10/21/1999	0.57 L	0.85	J 45.0	0.82	2.2	5.2	19.5 X	0.37 J	0.27 J
19739-442	2AB3-01	3.5	7/27/1999	0.35 L	2.2	47.9	1.1	7	7.2	5.6	1.2 J	0.39 J
19739-736	2AB4-03	11.4	9/24/1999	0.43 L	J 2.5	47	0.16 U	6.2	7.5	19.2 X	1.1 J	1.1 J
19739-439	2AB5-02	5.0	7/27/1999	0.14 L	1.8	35.6	0,0097 U	3.7	5.4	2.8	0.28 UJ	0.11 U-
19739-835	2AC2-07	8.5	10/21/1999	0.57 L	0.45	U 32.4	0.045 U	8.6	8.2	4.8	0.28 U	0,11 U
19739-831	2AC3-07	17.3	10/21/1999	0.59 L	1.3	41.9	1.5	8.5	6.6	10.1	2.0 X	2.55 X
19739-749	2AC4-05	24.8	9/24/1999	0.27 L	2.7	37.5	0.023 U	5.2	8.8	2.0 J	0.28 U	0.11 U
19739-745	2AC5-04	11.6	9/24/1999	0.28 ₺	2.3	54.6	0.024 U	6	6.7	4.8	0.29 UJ	0.12 U
19739-574	2AD2-03	10.4	8/23/1999	0.59 U	2.3	133	0.36 J	37.7 X	14 X	4.9	0.29 U	0,21 J
19739-576	2AD3-05	13.9	8/23/1999	0.61 L	2.5	43.7	0.041 U	7.4	7	3.0	0.29 U	0.12 U
19739-578	2AD4-05	14.8	8/23/1999	0.62 U	1.7	59.5	0.042 U	6.8	7.8	4.5	0.3 U	0.12 U
19739-739	2AD5-05	10.2	9/24/1999	0.39 U	3.9	79.2	0.096 U	11.9	8.9	11.4	1.7 J	3.3 X
19739-942	2AD6-03	5.5	11/15/1999	0.58 U	1.4	37.4	0.83 U	4.1	5.8	2.4	0.84 J	0.2 J
19739-363	2AE2-01	3.5	7/20/1999	0.35 U	1.4	87.1	0.074 U	21.2 X	10.7	2.7	0.28 U	0.17 J
19739-412	2AE3-01	10.5	7/22/1999	0.36 U	0.88	47.1	0.075 U	3.9	6.8	8.1	0.28 U	0.12 U
19739-411	2AE4-01	10.5	7/22/1999	0.38 U	2	62.4	0.081 ป	12.5	10.6	5.3	0.31 ป	0.36 J
19739-800	2AE5-03	15	10/13/1999	0.57 U	2.4	33.8	0.039 U	12.9	9.2	2.1	0.27 J	0.11 J
19739-409	2AE6-01	3.5	7/22/1999	0.39 U	1.8	87.1	0.082 U	7	9.9	4.7	0.31 U	0.35 J
19739-371	2AF3-01	5.5	7/20/1999	0,35 U	2.6	42.1	0.073 U	6.6	8.9	0.67 J	1.9 J	2.1 X
19739-365	2AF4-01	5.5	7/20/1999	0.35 U	0.84	J 20	0.075 U	4.3	4.2	3.6	0.28 U	0.11 U
19739-519	2AF5-03	9.8	8/12/1999	0.59 ປ	0.94	J 59.6	0.04 U	7.7	16.1 X	11.9	0.29 U	0.12 U
19739-370	2AF6-02	5.0	7/20/1999	0.15 U	1,6	66.9	0.01 U	2.2	13.7 X	6.4	0.29 U	0.12 U
			Average	0 43	1 83	54.58	0 25	8.80	8 60	6 39	0 61	0.56
		Standa		0.45	0.81	24.77	0.41	7.73	3.00	5.14	0.58	0.90
Standard Deviation Sample Number				22	22	24.77	22	7.73 22	22	5.14 22	22	22
	Stud	االعد ent's t Distrib		1.721	1.721	1.721	1.721	1.721	1.721	1.721	1,721	1.721
	Stud	EIK 2 L DISTAN										
			UCL _{96%}	049	2 13	63,67	0.41	11 64	9.70	8.27	0.82	0 9

			Analyte	Iron	Lead	Manganese	Mercury	Molybdenum	Silver	Thallium	Zinc
Cleanup Stan	idard *		0 to 5 feet	20 200 (B)	12 (PLE)	783 (PLE)	0.6 (PLE)	7.4 (B)	5 (PLE)	14(B)	163 (PLE)
			5 to 10 feet	_ ` .	130 (PRG)	3 200 (PRG)	-	_	-	5 4 (PRG)	23 000 (PRG)
			Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
	Sample										
Sample	Location	Sample	Date								
ldentifier	Number	Depth (feet)	Collected								
19739-837	2AB2-03	5.4	10/21/1999	26,400 X	5.6	208	0.026	1.9	0.2	0.35	35.0
19739-442	2AB3-01	3.5	7/27/1999	18,200	2.7	356	0.073 U	0.19 U	0.11 U	0.35 U	400 X
19739-736	2AB4-03	11.4	9/24/1999	15,200	21.6 X	185	0.027 U	0.37 U	0.094 U		78.1
19739-439	2AB5-02	5.0	7/27/1999	14,100	6.2	232	0.026 U	0,026 U	0.051 U	0.087 U	25.5
19739-835	2AC2-07	8.5	10/21/1999	21,600 X	2.6	288	0.026 U	0.14 U	0.2 U	0.35 U	33.9
19739-831	2AC3-07	17.3	10/21/1999	15,200	10.0	418	0.038 J	0.38 J	0,21 U	0.36 ປ	730 X
19739-749	2AC4-05	24.8	9/24/1999	20,800 X	1.6	344	0.026 U	0.23 U	0.092 U	0.35 U	25.7
19739-745	2AC5-04	11.6	9/24/1999	16,000	2.6	228	0.027 U	0.24 U	0.024 U	0,091 U	24.2
19739-574	2AD2-03	10.4	8/23/1999	23,300 X	1.9	257	0.027 ป	0.11 U	0.21 ปั	0.36 U	55.1
19739-576	2AD3-05	13.9	8/23/1999	17,200	1.2 J	268	0.027 U	0.11 U	0.22 U	0,37 U	22.6
19739-578	2AD4-05	14.8	8/23/1999	14,500	1.4	190	0.028 U	0.11 U	0.22 U	0.38 U	18.5
19739-739	2AD5-05	10.2	9/24/1999	27,600 X	8.0	218	0.027 U	0.24 U	0.096 U	0.37 U	66.5
19739-942	2AD6-03	5.5	11/15/1999	15,100	1.7	119	0.082 J	0.83 U	2.1 U	0.35 U	23.3
19739-363	2AE2-01	3.5	7/20/1999	19,200	3	253	0.072 U	0.7 J	0.11 U	0.35 U	29.8
19739-412	2AE3-01	10.5	7/22/1999	15,400	1.4	287	0.073 U	0.13 U	0.11 U	0.36 U	29.7
19739-411	2AE4-01	10.5	7/22/1999	23,400 X	6.2	247	0.079 U	0.18 U	0.12 U	0.38 U	34.7
19739-800	2AE5-03	15	10/13/1999	16,900	2.2	260	0.096 U	0.95	0,20 U	0.35 U	20
19739-409	2AE6-01	3.5	7/22/1999	24,800 X	ε	309	0.028 J	0.15 U	0.12 U	0.39 U	33
19739-371	2AF3-01	5.5	7/20/1999	20,800 X	2.9	368	0.071 U	1.2	0.11 U	0.35 U	44.1
19739-365	2AF4-01	3.5	7/20/1999	8,840	2.1	84.3	0.073 U	0.13 U	0,11 U	0.35 U	10.9
19739-519	2AF5-03	9.8	8/12/1999	30,200 X	2	211	0.017 J	0.11 U	0.21 U	0.36 U	40.3
19739-370	2AF6-02	5.0	7/20/1999	28,400 X	1.4	368	0.027 U	0.027 U	0,053 U	0.091 U	49,7
			Average	19,688	4.15	259,01	0.05	0 38	0.23	0 32	83.21
		Standar	rd Deviation	5.515	4.56	81.27	0.03	0.46	0.42	0.10	164.81
			ple Number	22	4.36	22	22	22	22	22	22
	C+1	am ent's t Distrib	•	1721	1.721	1.721	1.721	1.721	1.721	1.721	1.721
	2100	eur a r Diamo	rucion value	1721	1.721	1.721	1.723	1.721	1.721	1.721	1.721

288.83

Cleanup Standard ^a - Cleanup standards are based on background (B), preliminary limit of exposure (PLE), or the preliminary remediation goals (PRG)

5.82

21 712 X

UCL_{95%}

UCL 95% - upper 95-percent confidence limit mg/kg - milligrams per kilogram μg/kg - micrograms per kilogram

0.55

0.38

0.36

143.68

0.05

X - result exceeds the 0 to 5 foot cleanup standard

U - not detected above or equal to the stated reporting limit

J -- estimated value

U.J.- not detected at or above the stated reporting limit and an estimated value

APPENDIX A PRECONSTRUCTION BIOLOGICAL SURVEY REPORT

25 June 1999

Shane Austin IT Corporation 3347 Michelson Drive, Suite 200 Irvine, CA 92612

Subject: Pre-construction site assessment of 1F and 2A for IT Group, Camp Pendleton

MEC Analytical Systems, Inc (MEC) conducted a pre-construction biological review of two Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) sites on Marine Corps Base Camp Pendleton on 23 June 1999. The survey was conducted by MEC's wildlife biologist (Trisha Smith) and a biologist from Varanus Biological Services (Ingri Quon), who is qualified and permitted to survey California gnatcatcher, southwestern willow flycatcher, least Bell's vireo, California least tern, and arroyo toad

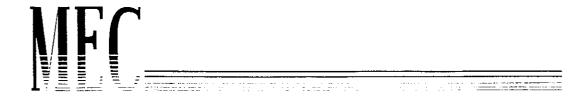
The soil material is contaminated with heavy metals and other man-made wastes. The project calls for vegetation to be cleared and contaminated soil to be removed and then replaced with clean fill. Each former stockpile/dump site was less than four acres of recovering native upland vegetation with some wetland-associated species in low lying site areas. Our task was to assess several sites for any significant biological changes or new environmental concerns since the biological assessment was completed on 20 May 1999. In addition to the two sites that would be cleared and excavated immediately, we conducted a walk-through of Site 1A. This site is comprised of sage scrub, baccharis scrub, and willow scrub that will be cleared in the late summer.

Site 1F

Site 1F was burned in 1997 and again in the fall of 1998 Site vegetation was predominantly dense, exotic, invasive annuals that surround a central drainage ditch vegetated with young willows and mulefat Several mature Mexican Elderberries (Sambucus mexicana) are growing just to the east of the drainage. One of the elderberry trees was the song perch of a solitary Yellow-breasted Chat (Icteria virens) The west edge of the site had several species of native annuals (for example, Canchalagua (Centaurium venustrum), Fascicled Tarwweed (Hemizonia fasciculata)) and bunch grasses emerging from sparsely populated compacted clay soil

The site was approved for excavation on the day of the pre-construction biological review Clearing began immediately following the walk-through. The equipment operator was told to avoid the native annuals as much as possible on the west edge of the site.

Photos of the site were taken prior to excavation



Site 2A

Site 2A was burned in 1997 On the day of the pre-construction screening the site was predominately vegetated with dried, exotic mustard, Deerweed (*Lotus scoparius*) and scattered, regenerating Laurel Sumac (*Malosma laurina*). The lower portion of the site was vegetated with sparse mulefat. Adjacent, surrounding vegetation was similar to on-site vegetation.

The site, staging area, temporary soil stockpile area, and equipment turn around area was biologically approved for project work on the day of the pre-construction biological screen. No rare or endangered species are expected at the site Excavation of the site and use of the adjacent areas was to begin this week or early next week

Photos of the site were taken prior to excavation

Site 1A

Site 1A is vegetated with mature willows and broom baccharis (*Baccharis sarothroides*) and is located along the west side of a riparian corridor. The adjacent, off-site upland vegetation to the west is mature coastal sage scrub. To the east is exotic grassland, formerly coastal sage scrub, located on the east side of the riparian corridor.

One Least Bell's vireo (a federally endangered species) and one Yellow-breasted chat (a California species of special concern) were detected within the work area of Site 1A A scolding, male California gnatcatcher (a federally threatened species) was detected just west of the site on the coastal sage scrub slope above work site Stake 1228

This site will require a pre-construction biological screening prior to scheduled clearing/cleaning in mid-August or September. We recommend clearing the work area in September following the departure of Least Bell's Vireo from the breeding grounds. A biologist knowledgeable of Least Bell's Vireo breeding behavior and who is permitted to look for nests should assess the area prior to commencement of work if begun prior to 15 August. Also, if work is initiated at the site prior to 15 September there is the possibility of a "take" of occupied vireo habitat. This requires documentation by a biologist prior to the commencement of any work in the area.

Please call me at (760) 931-8081 if you have any questions or concerns about the status of the designated work areas

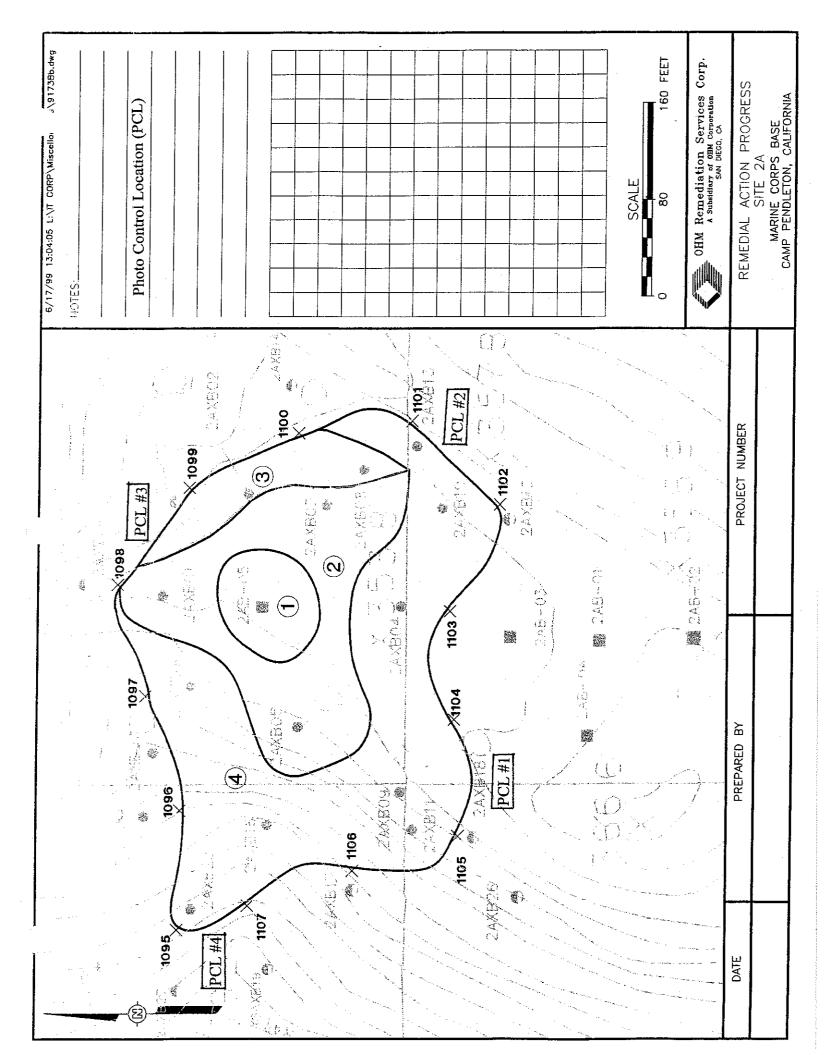
Sincerely,

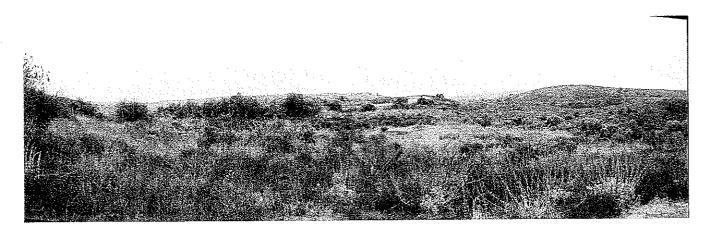
Karen Green

Project Manager and Biologist

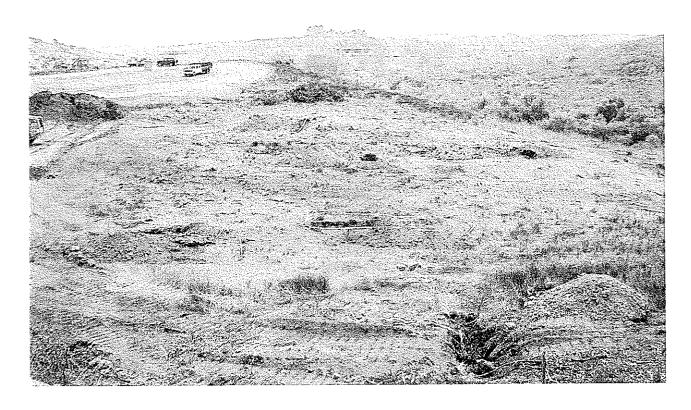
Haren Sheen

APPENDIX B PHOTOGRAPHS OF REMEDIAL CONSTRUCTION





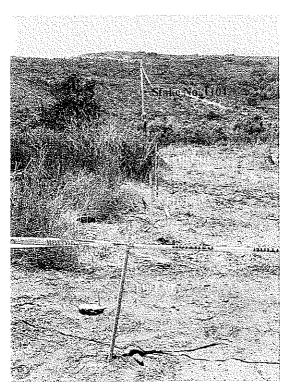
Photograph No. 1: Site 2A Before Soil Removal Activities (June 28, 1999)
Photo Control Location (PCL) #3



Photograph No. 2: Trenching Prior to Excavation Activities (June 29, 1999) PCL #3



Photograph No. 3: Second Day of Excavation and Stockpiling Activities (July 7, 1999) PCL #2



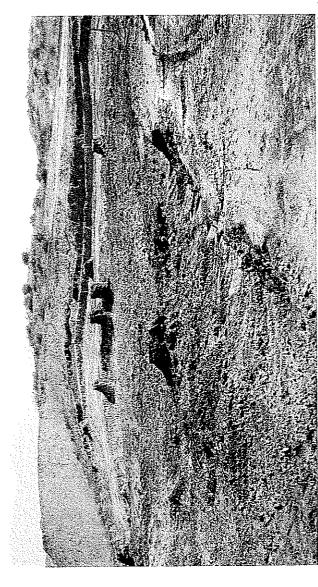
Photograph No. 4: Perimeter Stake Location No. 1104, Stepped out 10, 20 and 30 feet (July 6, 1999)



Photograph No. 5: Loading Contaminated Soil for Transport to CAMU, Upper Loading Area (July 14, 1999) PCL #3

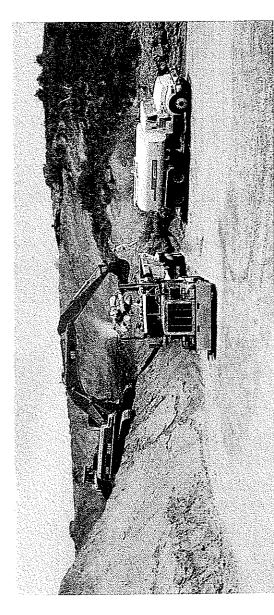


Photograph No. 6: Site 2A Remedial Excavation in Progress (July 19, 1999) PCL #3



Photograph No. 7: Ash Debris at Planned Excavation Depths, Unexcavated soil monuments used for depth control in background (July 22, 1999)

PCL #1

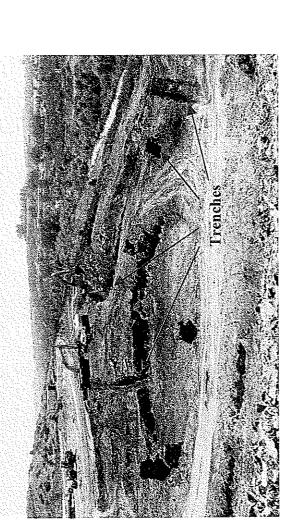


Photograph No. 8: Loading Contaminated Soil for Transport to CAMU, Lower Loading Area, west side of site (July 28, 1999)

PCL #4



Photograph No. 9: Site 2A Condition at the Completion of Planned Excavation (July 28, 1999)
PCL #3



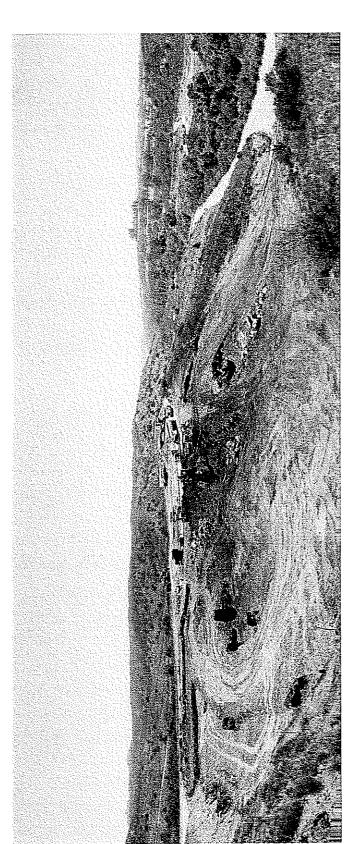
Photograph No. 10: Trenching Prior to Over-Excavation Activities (August 2, 1999) PCL #3



Photograph No. 11: Close-Up of Concrete Debris Found Near Grid Point C3 During Trenching (August 2, 1999)



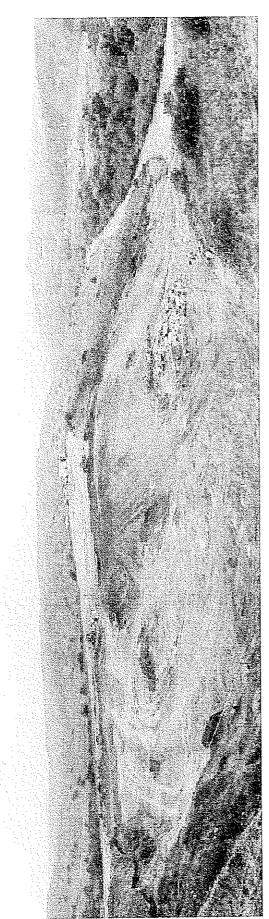
Photograph No. 12: Site 2A Over-Excavation in Progress (August 5, 1999) PCL #3



Photograph No. 13: Site 2A Over-Excavation in Progress, Large Concrete Debris near Grid Point C3 Revealed (August 19, 1999)

PCL #3

Photograph No. 14: Olive-Green Material Uncovered near Grid Point E5, During Over-Excavation Activities (September 2,1999)

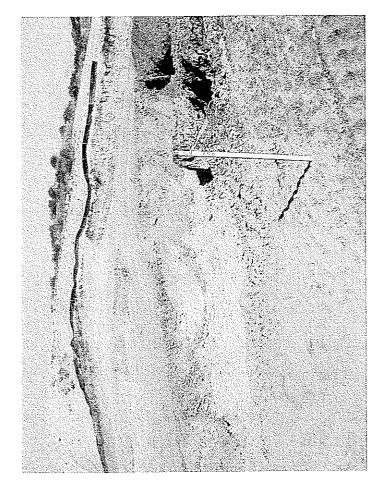


Photograph No. 15: Site 2A Condition at the Completion of Overexcavation (September 24,1999) PCL #3

B-7

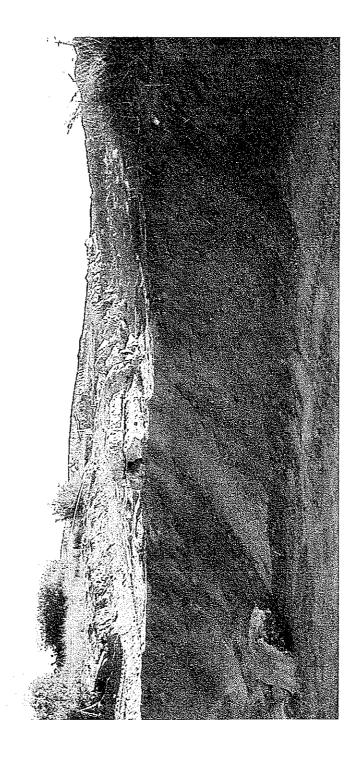


Photograph No. 16: Site 2A Final Excavation Activities in Progress (October 25,1999) PCL #3

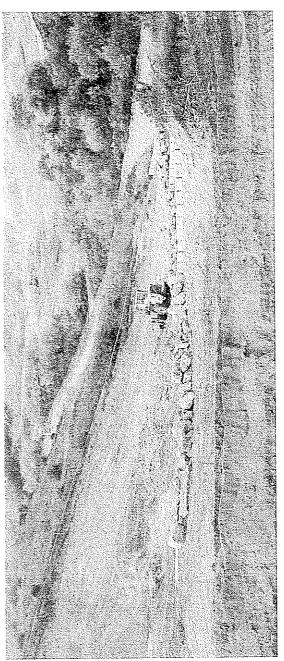


Photograph No. 17: Pockets of Contaminated Material near Grid Point D6 Found During Final Excavation (November 3,1999)

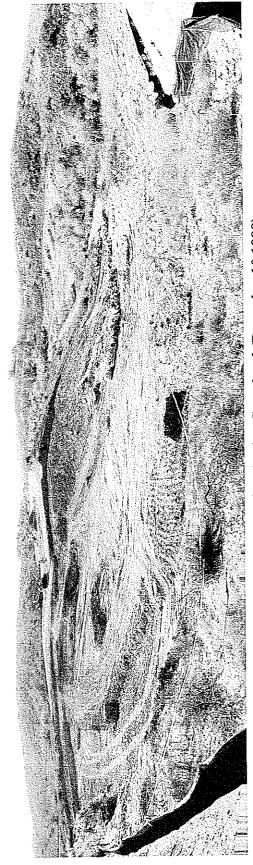




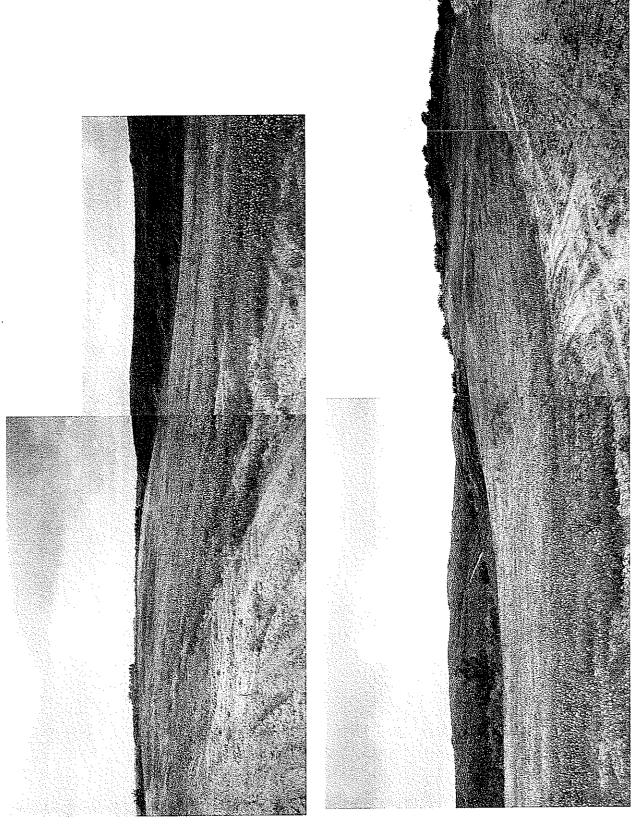
Photograph No. 19: Excavated Concrete as Rip-Rap for Winterization (November 23,1999) PCL #4



Photograph No. 20: Winterization (November 30,1999) PCL #3



Photograph No. 21: Winterization Completed (December 10,1999) PCL #3



Site Grade Restored and Revegetated (April 11, 2001) PCL #2

APPENDIX C CONTRACTOR QUALITY CONTROL REPORT



August 24, 2000 Project No. 103067-16

Mr Max Pan OHM Remediation/IT Group 1202 Kettner Blvd, Suite 3400 San Diego, California 92101

Subject:

Summary of Earthwork Observation and Compaction

Testing Services for the Box Canyon Landfill Site 2A

Camp Pendleton, California

INTRODUCTION

In accordance with your request, Ninyo and Moore's field representatives have provided geotechnical observations and compaction testing services during the earthwork operations at the Box Canyon Landfill Site 2A. The purpose of our services was to observe and test the placement of backfill material. We performed field and laboratory tests of representative soil samples to evaluate relative compaction of the backfill placed at the site. Our findings and conclusions are presented herein

EARTHWORK OPERATIONS

Earthwork operations commenced on June 27, 2000, and were generally completed on July 13, 2000. Our field technicians were generally on an on-call basis during the soil fill placement operations. Compaction test results were communicated to the client's representative on a daily basis to determined compliance with project specifications.

During the earthwork operations, the contractor used a combination of earthmoving and compaction equipment to achieve the project specifications. Generally, a CAT 140H motor grader, a CAT 815B sheepsfoot vibratory roller compactor, and a water truck were used to perform the earthwork operations. In preparation for the soil fill placement operation, on-site materials were processed and moisture conditioned using a water truck or water hose. The material was then placed in compacted lifts using a CAT 815B sheepsfoot vibratory roller compactor.

FIELD AND LABORATORY TESTING

In-place density and moisture content testing was performed by our field representative in accordance with ASTM D2922-91 and D3017-88 (Nuclear Gauge Method) The summary results of field density tests are presented in Table 1 The approximate test locations of compacted fill material are plotted in Figure 1.

Laboratory tests were performed on representative samples of the fill materials to evaluate maximum dry density, optimum moisture content, and gradation. Maximum dry density and optimum moisture content tests were performed in general accordance with ASTM D1557-91. The results of the maximum dry density and optimum moisture content tests are presented in Table 2. Sieve analysis tests were performed in general accordance with ASTM D 422-63, and the results are presented in Table 3.

SUMMARY

Our field technician was generally on-site on an on-call basis during the backfill operations. Compliance of relative compaction and moisture content with the project specifications was determined by the client's representative in the field

LIMITATIONS

The geotechnical services outlined in this report have been conducted in accordance with current practice and the standard of care exercised by geotechnical consultants performing similar tasks in this area. No other warranty, expressed or implied, is made regarding the observations and conclusions expressed in this report. The reported test results represent the relative compaction and moisture content at the locations tested. It is important to note that the precision of field density tests and the maximum dry density tests is not exact and variations should be expected. The reported locations and elevations of the density tests are estimated based on correlations with the site plans. Further accuracy is not implied.

We appreciate this opportunity to be of service. If you should have any questions regarding this report, please contact the undersigned

Respectfully submitted, NINYO & MOORE

Luis A Labrada Staff Engineer

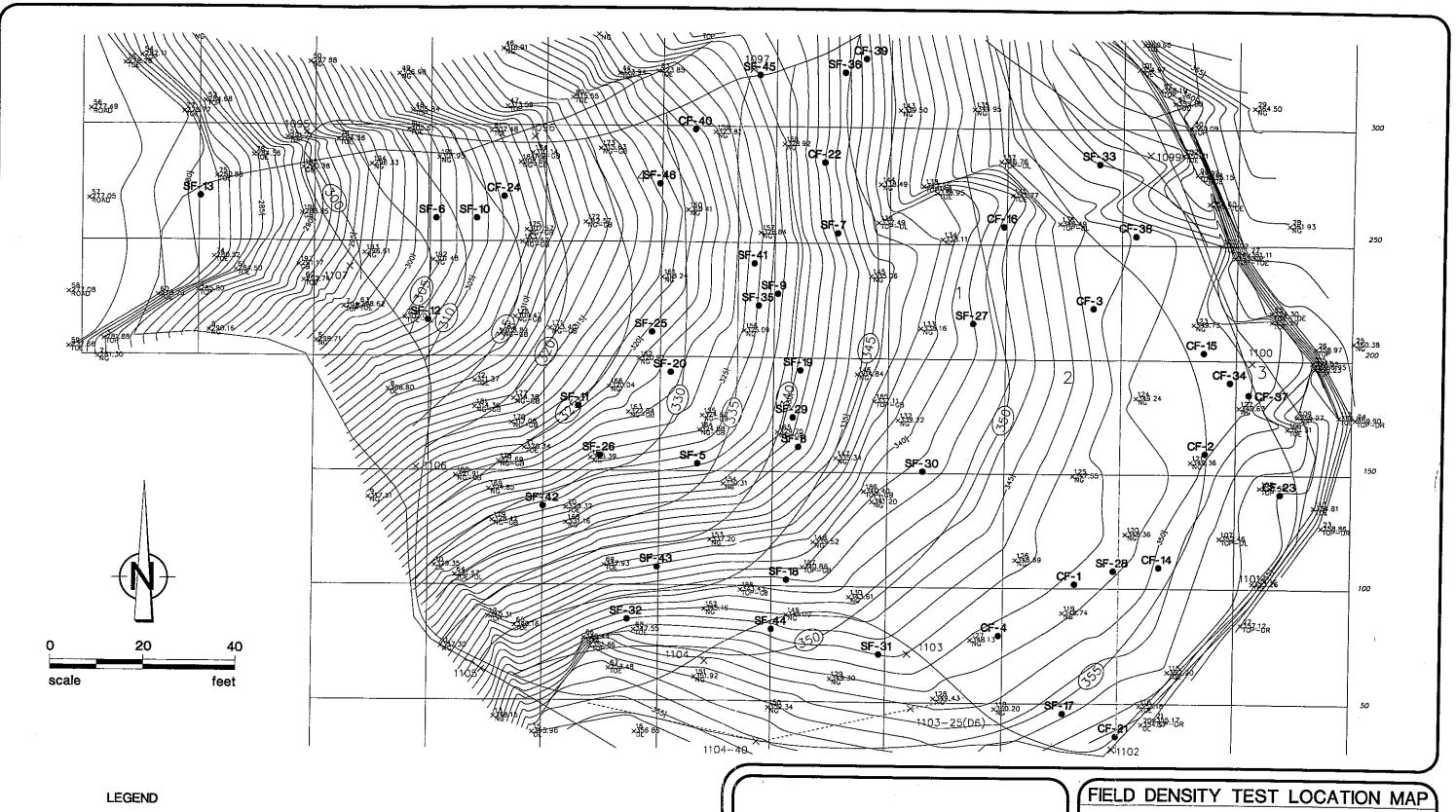
Mark Cuthbert, P.E. Principal Engineer

LAL/MC/lal

Attachments: Table 1 – Summary of Field Density Tests for Project No. 103067-16

Table 2 – Maximum Density Test Results Table 3 – Sieve Analysis Test Results

Distribution: (2) Addressee



• **CF-39** Approximate location of slope face

• SF-46 Approximate location of compacted fill

Ninyo & Moore_

BOX CANYON LAND FILL SITE 2A OCEANSIDE, CALIFORNIA

PROJECT NO.	DATE	FIGURE
103067-16	8/00	(1

Explanation of Summary of Field Density Tests

Test No :

1#

Field Density Test by nuclear Method

(ASTM D2922-91 and D3017-88)

Test No.:

CF

Compacted Fill

SF

Slope Face

NOTE: Description of Soil Types are presented in Table 2.

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TABLE 1
PAGE 1

SUMMARY OF FIELD DENSITY TESTS FOR PROJECT NO. 103067-16 COMPACTED FILL

	г		_				-				-	_			_							_				_	-	-			==	$\overline{}$	_				Ī				-
	Namo O	NGIII NG																												RETEST ON 30#	100 10 11111	5									
	Soil	No.	-	-	_	-	-	-	-	-	_	-		_	-	_	1	-	-	-	-	1	-	_	_		-	-	 ,	- ,			. ←		_	-	-	_	-	-	_
3	ve	Spec. (%)	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	90	8	8	8	8	8	06	8	8 8	3 8	8 8	8	06	96	06	90	90	90	06	9.0
7	Relative Compaction	Tested S (%)	8	<u></u> 응	8	32	91	91	06	95	2	8	٦	- 26	91	75	95	25	93	93	26	95	90	35	06	26	35	8	63	89 6	3 2	2 6	8	5	52	8	96	91	8	بر ا	80
		Max. Te (pcf) (123.2	123.2	123.2	123.2	123.2	123.2	123.2	123.2	123.2	123.2	123.2	123.2	123.2	123.2	123.2	123.2	123.2	123.2	123.2	123.2	123.2	123.2	123.2	123.2	123.2	123.2	123.2	123.2	2.621	123.2	123.2	123.2	123.2	123.2	123.2	123.2	123.2	3.2	123.2
OWIL INC	Dry Density		-					-				-		_	`													_				-				_					_
3	٥	Field (pcf)						_				-					_														747.0	+			2 116.6		_				2 1 110.9
	Moisture Content	0pt (%)	11.2	11.2	11.2	11.2	11,2	11.2	11.2	11.2		-	11.2	11.2	11.2		-		11.2	11.2	11.2				11.2						7.1.	+					-			11.2	┥
	Mot	Field (%)	12.0	12.7	11.4	11.0	11.2	11.2	12.0	9.3	11.2	10.6	12.7	11.9	11.5	11.2	10.8	10.5	11.5	12.4	9.1	9.8	0.6	10.9	11.2	10.6	9.2	9.5	10.4	10.9	, , ,	10.5	10.0	11.5	9.5	9.0	8.7	10.5	9.8	10.	10.3
	pprox	(ft)	350.0	351.0	350.0	348.0	333.0	308.0	348.0	338.0	337.0	307.0	321.8	306.5	288.0	352.5	354.0	351.0	353.0	344.0	332.5	328.0	355.0	348.0	356.0	309.0	328.0	324.5	343.0	346.0	333.0	350.0	346.5	353.0	353.5	336.0	345.5	356.0	355.0	340.0	525.0
		lest Location	SEE FIGURE NO. 1		SEE FIGURE NO. 1		FIGURE		FIGURE	FIGURE	FIGURE	FIGURE		FIGURE	FIGURE	FIGURE		SEE FIGURE NO. 1	FIGURE	SEE FIGURE NO. 1	FIGURE	FIGURE		F1GURE	FIGURE	FIGURE	SEE FIGURE NO. 1	FIGURE	FIGURE	FIGURE	SEE FIGURE NO. 1	SEE FIGURE NO. 1	SEE FIGURE NO. 1		FIGURE	FIGURE	SEE FIGURE NO. 1				
1	est	of	CF SE		CF SE	CF SE	CF SE	CF SE	SF SE								CF SE					SFS		CF SI							5 t	\top	_		S.	SFS	SFS	CF.		<u>د</u>	S S
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		l vate	06/22/00	06/27/00	06/22/00	06/27/00	06/28/00	06/28/00	06/28/00	06/28/00	06/28/00	06/28/00	06/52/00	06/29/00	06/25/00	06/25/00	00/02/90	06/30/00	06/30/00	00/30/00	00/02/90	06/30/00	00/50/20	02/02/00	02/02/00	00/50/20	02/02/00	02/02/00	00/90/20	00/90/20	00/30/20	00/20/20	00//0//00	02/02/00	02/110/00	02/10/00	07/10/00	02/11/00	02/11/00	07/11/00	10/11//00
		rest NO.	1#	#	3#	#5	#5	#9	#	#8	#6	10#	11#	12#	13#	17#	15#	16#	17#	18#	16#	50#	£12	52#	23#	# 5 2	52#	#92	27#	28#	#67	31#	32#	33#	34#	35#	36#	37#	38#	36#	#04

TABLE 1 PAGE 2
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ingo & A
>

										 					
SUMMARY OF FIELD DENSITY TESTS FOR PROJECT NO. 103067-16 COMPACTED FILL	Domorks	Nellidi No													
1030 1030	Soil	No.	-	-	_	-	- -			<u></u>	<u> </u>			 	
FIEL NO.	Relative Compaction	(%) .pec	8	8	8	8	8 8			 			· <u>-</u>	. <u> </u>	
COF ECT ED F	Rela	Tested Spec (%) (%)	90	8	8	7	8								
AROJ PACT	ty		123.2	123.2	123.2	123.2	123.2			 					
SUMMARY OF FIEI FOR PROJECT NO. COMPACTED FILL	Dry Density	Field (pcf)	-			_	112.2				***				
мщо	ıre nt	0pt. (%)					11.2					· · ·		····	
	Moisture Content	Field ((%)	8.0				9.5		140						
TABLE 1 PAGE 2	prox		337.1	332.1	341.0		323.0	· · · · · · · · · · · · · · · · · · ·		 				- 4.	
TABL PAGE 2	₽.		3	Μ.	m	M	χ1 K3								
<i>Ningo «</i> Moore		IEST LOCALION	FIGURE	FIGURE	SEE FIGURE NO. 1	SEE FIGURE NO. 1	SEE FIGURE NO. 1 SEE FIGURE NO. 1								
	Test	oŧ	SF			Ş	75 P.	·		 			····		
	+	nare	02/11/00	02/11/00	07/12/00	07/12/00	07/13/00	· · · · · · · · · · · · · · · · · · ·		 					
	- C	lest NO.	#15	#24	#25	#77	#95								

Table 2 - Maximum Density Test Results

Soil Type No.	Description	Maximum Dry Density (pcf)	Optimum Moisture Content (%)
1	Brown Clayey SAND with Gravel	123 2	11 2

Table 3 - Sieve Analysis Test Results

Sieve	Percent Passing
Size	Soil Type No. 5
1"	
3/4"	
1/2"	
3/8"	100
#4	100
#8	98
#16	93
#30	75
#50	50
#100	32
#200	21

APPENDIX D SITE REVEGETATION SEED MIX

Hydroseeding Specifications

Hydroseeding shall be used to establish ground cover and introduce an upland native seed mix to each site. Application of hydroseed shall begin no less than 30 days following the placement of soil amendments where required, unless otherwise directed by IT. The hydroseed mixture shall consist of the three parts described below:

• Upland native seed mix at a rate of 55 pounds per acre. The seed mix shall consist of the following:

Botanical Name	Common Name	Pounds/Acre	Purity/Germination
Artemisia californica	California Sage Brush	4	50/15
Encelia californica	Bush Sunflower	3	60/40
Eschschlozia californica	California Poppy	2	75/98
Lotus scoparius	Deerweed	8	60/90
Eriogonum fasciculatum	California Buckwheat	8	65/10
Lasthenia glabrata	Goldfields	2	85/90
Lupinus succulentus	Arroyo Lupine	4	85/90
Eriophyllum confertiflorum	Golden Yarrow	3	60/30
Salvia apiana	White Sage	4	50/70
Sisyrinchium bellum	Blue-Eyed Grass	1	75/95
Diplacus longiflor-us	Monkey Flower	2	55/2
Salvia mellifera	Black Sage	4	50/70
Nassella pulchra	Purple Needlegrass	2	70/60
Bromus arizonicus	Cucamonga Brome	5	95/80
Melica california	California Melic	3	90/60
	Total Pounds Per Acre	55	

- Fiber mulch at a rate of 2,000 pounds per acre.
- Organic soil stabilant (tackifier) at a rate of 140 pounds per acres.

The fiber mulch shall be a specifically prepared virgin wood cellulose fiber, which has been thermomechanically processed for specific use as hydromulch. The fiber mulch shall also contain non-toxic green dye to provide a gage for metering of material over ground surfaces. The tackifier shall be a non-toxic commercial product typically used for binding soil and mulch in erosion control seeding operations. The hydroseeding shall be performed from late October to late November before the start of the winter rainy season

Field Quality Control

The following activities will be performed by IT during the site restoration process:

- Visual inspections will be performed to verify that proper amount of compost (based on number of truck loads and surface area), gypsum, and fertilizer are applied and that they are thoroughly mixed with the upper six inch of backfill soil.
- Visual inspection of the hydroseeding process to verify that the proper amount of each of the components is applied.

• Document the visual inspection and all field activities in details. Take photographs as required to show the field conditions before, during, and after the revegetation effort.

Compile field documentation into the final site closure as-built report as required.

APPENDIX E ANALYTICAL DATA SUMMARY AND EVALUATION

Data Summary and Evaluation - IR Site 2A Remedial Action Confirmation Sampling Results

E 1 Introduction

This report addresses the validity and quality of the data collected for the soil remedial excavation activity at Operable Unit (OU) 3, IR Site 2A located at Marine Corps Base (MCB) Camp Pendleton, San Diego County, California. Pesticides and metals analytical data for were reviewed and validated in accordance with a modified outline of the <u>United States Environmental Protection Agency (US EPA) National Functional Guidelines for Inorganic and Organic Data Review, December, 1994</u> The National Functional Guidelines, which are an outcome of the CERCLA and the CLP, were used as a framework for the validation of data generated using SW846 methodology

Laboratory data were subjected to a four-stage process of evaluation that included completeness checks, verification of hard copy and electronic results, third-party validation of the data, and final evaluation based on the best judgment of the project chemist

The data from all final perimeter (wall) samples collected in March 1999 and from all final floor confirmation samples collected between July and November 1999 were validated based on Level C or Level D (NFESC, 1996) guidelines Organic data were validated against the following criteria:

- holding times
- initial and continuing calibrations
- · method blanks
- surrogate recoveries
- matrix spike/matrix spike duplicate (MS/MSD) recoveries and relative percent difference (RPD)
- laboratory control sample/laboratory control sample duplicate (LCS/LCSD) recoveries and RPD
- DDT breakdown
- duplicate field sample RPD
- result forms and laboratory logs
- field and quality control sample raw data (Level D only)

Inorganic data were validated against the following criteria:

- holding times
- initial and continuing calibrations
- method blanks, initial and continuing blanks
- interference check standards A and B
- matrix spike/matrix spike duplicate (MS/MSD) recoveries and relative percent difference (RPD)
- laboratory control sample/laboratory control sample duplicate (LCS/LCSD) recoveries and RPD
- serial dilution spike recoveries
- duplicate field sample RPD
- result forms and laboratory logs
- field and quality control sample raw data (Level D only)

The laboratory was instructed to prepare data packages such that 90% met Level C requirements and 10% met Level D requirements

Data qualification was based on the field and analytical protocols detailed in the *Draft Final Remedial Design and Remedial Action Work Plan, Marine Corps Base Camp Pendleton California (OHM May 1999)* Pertinent data qualifiers are defined as follows:

U: Analyte was analyzed for but not detected at or above the listed limit of detection

J: Analyte detected with uncertainty in the reported concentration

UJ: Analyte was not detected with uncertainty in the reported detection limit

R: Data are unusable (i e., rejected)

Pertinent sample results and their associated data qualifiers are presented in Table E-1 and Table E-2 of this report. Analytical services were provided by Applied Physics and Chemistry Laboratory in Chino, California. Data validation was performed by Laboratory Data Consultants, Inc., in Carlsbad, California.

Although the QAPP lists EPA Method 7060A as the method for analyzing arsenic, the laboratory used EPA Method 6010A, which is a procedurally and technically satisfactory method Furthermore, the level of detection was not compromised by using Method 6010A.

Results were reported to the method detection limit (MDL) or instrument detection limit (IDL), rather than the reporting limit (RL), for some of the analytes to help meet Preliminary Remediation Goals (PRGs). Results that are reported between the RL and the IDL (or MDL) have been assigned a "J" footnote—Those analytes that were reported to the IDL are antimony and thallium and those analytes reported to the MDL are 4,4'-DDD and 4,4'-DDE

E.2 Analytical Quality Control Program

This section provides a description of the field and laboratory quality control (QC) sample results, which were used to evaluate precision, accuracy, representativeness, completeness, and comparability (PARCC)

Precision

Precision was evaluated based on results from QC samples collected in the field and on results from QC samples generated in the laboratory. Analytical precision is assessed by calculating the RPDs of the LCS/LCSD and the MS/MSD. Total precision, which is a measure of variability as a function of field and analytical procedures, is assessed by calculating the RPD of the field duplicate samples. The RPD for MS/MSD or duplicate samples is not calculable when one or both results were not detected.

The precision results for all samples were within the required QC limits with the following exceptions:

<u>Sample/Duplicate</u> 19739-412/413	Analyte copper lead	RPD (%) 51 70
19739-736/737	4,4-DDE	84
19739-831/832	arsenic cadmium chromium copper lead molybdenum	99 74 56 45 40 117
	zinc	66

Accuracy

Accuracy was evaluated based on the percent recovery of spiked analytes at known concentrations in MS/MSDs and LCS/LCSDs. In addition, evaluation of the initial and continuing calibration results provided information on analytical accuracy.

Accuracy for all samples were within the required QC limits with the following exceptions:

Percent recoveries of antimony, barium, chromium, cobalt, copper, lead, manganese and zinc in
the MS/MSD linked with the laboratory batch including samples 2A-1102, 2A-1101, 2A-1100,
2A-1099, 2A-1098, 2A-1096 and 2A-1095 were outside the QC acceptance limits However, the
percent recoveries of analytes in question in the associated LCS/LCSD were within the QC
acceptance limits indicating acceptable batch accuracy and therefore the affected result was not
qualified

Representativeness

Representativeness is a qualitative parameter that is described by the degree of accuracy and precision of the sample data and their reflection on the environment from where the samples were collected, conditions present during sample collection, or the attributes of a sample population.

The data presented in Table E-1 and Table E-2 of this report were found to be representative

Completeness

Completeness is determined by calculating the number of valid measurements (or results) for each matrix and analyte combination. (A valid result is one that has not been "R" qualified) The formula for completeness is the number of valid measurements divided by the total number of measurements multiplied by 100. A particular set of data is considered complete if, at a minimum, 90% of soil samples or 95% of aqueous samples meet the completeness criterion.

The data presented in Table E-1 and Table E-2 of this report were found to be complete.

Comparability

To ensure comparability, the Work Plan detailed specific procedures for both field and laboratory activities. Furthermore, the Work Plan required the laboratory to reference US EPA analytical methods, and all soil samples were reported on a dry weight basis.

No significant deviations from standard analytical protocols were reported by the laboratory

E.3 Summary

The data associated with the excavation activities at Site 2A at MCB Camp Pendleton described in this report are usable and acceptable as qualified Overall precision and accuracy objectives were met. The analytical results with their associated qualifiers are summarized in Table E-1 and Table E-2

Table E-1

Summary of Final Perimeter (Wall) confirmation Sampling Results

	,		6					
Sample Identification		19739-117	19739-119	19739-121	19739-123	19739-125	19739-130	19739-133
Location Code		2A-1102	2A-1101	2A-1100	2A-1099	2A-1098	2A-1096	2A-1095
Date Sampled		03/29/99	03/29/99	03/29/99	03/29/99	03/29/99	03/29/99	03/56/60
Depth (feet below ground surface)		1.5	5.1	3.5	3.5	2.5	1.5	, , , , , , , , , , , , , , , , , , ,
	Unit							
EPA 6010A								
Antimony	mg/kg	0.27 U	0.061 U	0.26 U	0.25 U	0.25 U	0.25 U	0.25 U
Arsenic	mg/kg	2.3	1.5	2.4	1.9	1.9	1.7	2.4
Barrum	mg/kg	73.3	40.3	61.1	106	46.6	43.0	46.8
Cadmium	mg/kg	0.058 U	0.076 U	0.057 U	0.054 U	0.055 U	0.053 U	0.054.11
Chromum	mg/kg	2.8	6.4	8.1	18.4	10	44	5.4
Cobalt	mg/kg	12.0	5.0	16.0	11.7	7.3	6")	7.5
Copper	mg/kg	9.1	9.5	5.0	4.6	0.23	5.5	5.0
Iron	mg/kg	28800	14200	26700	23000	19600	15500	18300
Lead	mg/kg	8.5	23.5	2.6	1.3 J	6.3	2.3	2.6
Manganese	mg/kg	377	151	277	301	253	226	242
Molybdenum	mg/kg	0.11 U	0.024 U	0.10 U	0.10 U	0.10 U	11 62:0	11 02 0
Silver	mg/kg	0.072 U	0.016 U	0.070 U	U 190'0	0.068 U	0.065 U	11 990 0
Thallium	mg/kg	0.31 U	0.071 U	0.31 U	0.29 U	0.30 U	0.29 U	0.29 11
Zinc	mg/kg	64.4	35.9	24.2	30.9	78.8	25.0	30.0
EPA 7470A7471A	1						7.04	50.5
Mercury	mg/kg	0.20 J	0.050 U	0.053 U	0.051 U	0.052 11	0.050 11	0.051.11
EPA 808I						1		0 1000
4,4'-DDD	нв/кв	0.5 #	0.6 J	0.29 U	0.27 U	0.28 U	0.27 11	11 05 0
4,4'-DDE	нв/кв	0.7 J	3	0.12 U	0.11 U	0.12 U	0 11 11	0.52.0
								0 27.10

EPA - US Environmental Protection Agency

 $[\]ell$ - estimated value U - not detected at or above the stated reporting limit

mg/kg - milligrams per kilogram NA - not analyzed

μg/kg - nncrograms per kilogram

Table E-1

Summary of Final Perimeter (Wall) confirmation Sampling Results

•		19739-135	19739-137	19739-141	19739-314	19739-423
Location Code		2A-1106	2A-1107	2A-1105	2A-1097-20'	2A-1104-40'
Date Sampled		03/30/99	03/30/99	03/30/66	66/90/20	07/22/99
Depth (feet below ground surface)		1.5	1.5	1.5	1.5	1.5
	Unit					
EPA 6010A						
Antimony	mg/kg	0.25 U	0.24 U	0.25 U	0.45 U	0.57
Arsenic	mg/kg	2.3	7.5	3.7	2.4	1.6
Вагит	mg/kg	60.5	75.6	66.7	39.8	71.3
Cadmium	mg/kg	0.054 U	0.45 J	0.055 U	0.045 U	0.16 J
Chronnum	mg/kg	9.9	2.5	3.1	16.5	6.9
Cobalt	mg/kg	8.2	6.3	8.0	6.9	8.9
Copper	mg/kg	7.9	11.5	21.1	4.7	13.3
Iron	mg/kg	21000	19500	29200	17400	22100
Lead	mg/kg	7.8	2.2	2.4	2.3	7.0
Manganese	mg/kg	270	276	229	207	324
Molybdenum	mg/kg	O.099 U	0.098 U	0.10 U	1:1	0.45 J
Silver	mg/kg	0.066 U	0.065 U	0.067 U	0.19 U	0.20 U
Thallium	mg/kg	0.29 U	0.29 U	0.29 U	0.41 U	0.43 U
Zinc	mg/kg	40.2	148	35.4	25.4	42.4
EPA 7470A7471A		-				į
Mercury	mg/kg	0.036 J	0.050 U	0.051 U	0.062	0.075 U
EPA 8081						
4,4'-DDD	µg/kg	l. 9.0	f I	0.28 U	0.27 U	0.29 U
4,4'-DDE	μg/kg	4.5	0.1 J	0.11 U	0.22 J	1.3 J

EPA - US Environmental Protection Agency

J - estimated value

U - not detected at or above the stated reporting limit mg/kg - milligrams per kilogram

NA - not analyzed

μg/kg - micrograms per kilogram

Table E-2

Summary of Final Floor Confirmation Sampling Results

•		0						
Sample Identification		19739-363	19739-365	19739-370	19739-371	19739-409	19739-411	19739-412
Location Code		2A-E2-01	2A-F4-01	2A-F6-02	2A-F3-01	2A-E6-01	2A-E4-01	2A-E3-01
Date Sampled		07/20/99	07/20/99	07/20/99	07/20/99	07/22/99	07/22/99	07/22/99
Depth (feet below ground surface)		3.5	5.5	5.0	5.5	3.5	10.5	10.5
	Unit							
EPA 6010A								
Antimony	mg/kg	0.35 U	0.35 U	0.15 U	0.35 U	0.39 U	0.38 U	0.36 U
Arsenic	mg/kg	1.4	0.84 J	1.6	2.6	1.8	2.0	0.88 J
Вапит	mg/kg	87.1	20.0	6'99	42.1	87.1	62.4	47.1
Cadmium	mg/kg	0.074 U	0.075 U	0.010 U	0.073 U	0.082 U	0.081 U	0.075 U
Chromium	mg/kg	21.2	4.3	2.2	9.9	7.0	12.5	3.9
Cobalt	mg/kg	10.7	4.2	13.7	8.9	6.6	10.6	8.9
Copper	mg/kg	2.7	3.6	6.4	0.67 J	4.7	5.3	8.1
Iron	mg/kg	19200	8840	28400	20800	24800	23400	15400
Lead	mg/kg	3.0	2.1	4:1	2.9	3.0	6.2	4.1
Manganese	mg/kg	253	84.3	368	368	309	247	287
Molybdenum	mg/kg	0.70 J	0.13 U	0.027 U	1.2	0.15 U	0.18 U	0.13 U
Silver	mg/kg	0.11 U	0.11 U	0.053 U	0.11 U	0.12 U	0.12 U	0.11 U
Thallium	mg/kg	0.35 U	0.35 U	0.091 U	0.35 U	0.39 U	0.38 U	0.36 U
Zinc	mg/kg	29.8	6'01	49.7	44.1	33.0	34.7	797
EPA 7470A/7471			•				•	ì
Mercury	mg/kg	0.072 U	0.073 U	0.027 U	0.071 U	0.028	[] 670.0	0.073.11
EPA 8081								
4,4'-DDD	µg/kg	0.28 U	0.28 U	0.29 U	1.9.1	0.31 U	0.31 U	0.28 U
4,4'-DDE	μg/kg	0.17 J	0.11 U	0.12 U	2.1	0.35 J	0.36 J	0.12 U

EPA - US Environmental Protection Agency

J - estimated value

U - not detected at or above the stated reporting limit U - not detected at or above the stated reporting limit and the stated reporting limit is estimated

D - Duplicate sample mg/kg - milligrams per kilogram NA - not analyzed

μg/kg - micrograms per kilogram

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Table E-2

Summary of Final Floor Confirmation Sampling Results

Sample Identification		19739-413D	19739-431	19739-439	19739-442	19739-519	19739-574	19739-576
Location Code		2A-E3-01	2A-E5-01	2A-B5-02	2A-B3-01	2A~F5-03	2A-D2-03	2A-D3-05
Date Sampled		07/22/99	04/27/0	07/27/99	07/27/99	08/12/99	08/23/99	08/23/99
Depth (feet below ground surface)		10.5	15.0	5.0	3.5	8.6	10.4	13.9
	Unit							
EPA 6010A								
Antimony	mg/kg	0.35 U	0.36 U	0.14 U	0.35 U	0.59 U	0.59 U	0.61 U
Arsenic	mg/kg	1.3	1.5	8:	2.2	0.94 J	2.3	2.5
Barıum	mg/kg	39	79.5	35.6	47.9	59.6	133	43.7
Cadmium	mg/kg	0.074 U	0.076 U	0.0097 U	11	0.04 U	0.36 J	0.041 U
Chromium	mg/kg	3.6	7.9	3.7	7.0	7.7	37.7	7.4
Cobalt	mg/kg	7.6	9.6	5.4	7.2	16.1	14.0	7.0
Copper	mg/kg	4.8	7.4	2.8	5.6	11.9	4.9	3.0
Iron	mg/kg	15000	19200	14100	18200	30200	23300	17200
Lead	mg/kg	2.9	8.1	6.2	2.7	2.0	1.9	1.2 J
Manganese	mg/kg	247	375	232	356	211	257	268
Molybdenum	mg/kg	0.13 U	0.13 U	0.026 U	0.19 U	0.11 U	0.11 U	0.11 U
Silver	mg/kg	0.11 U	0.11 U	0.051 U	0.11 U	0.21 U	0.21 U	0.22 U
Thallium	mg/kg	0.35 U	0.36 U	0.087 U	0.35 U	0.36 U	0.36 U	0.37 U
Zinc	mg/kg	33.3	33.1	25.5	400	40.3	55.1	22.6
EPA 7470A/7471								
Mercury	mg/kg	0.072 U	0.028 J	0.026 U	0.073 U	0.017	0.027 U	0.027.11
EPA 8081								
4,4'-DDD	µg/kg	0.91 J	0.23 U	0.28 UJ	1.2 J	0.29 U	0.29 U	0.29 U
4,4'-DDE	µg/kg	i.1 J	0.20 U	0.11 UJ	0.39 J	0.12 U	0.21 J	0.12 U

EPA - US Environmental Protection Agency

J - estimated value

U - not detected at or above the stated reporting limit a U - not detected at or above the stated reporting limit a

D - Duplicate sample mg/kg - milligrams per kilogram NA - not analyzed

Table E-2

Summary of Final Floor Confirmation Sampling Results

Sample Identification		19739-578	19739-736	19739-737D	19739-739	19739-745	19739-749	19739-800
Location Code		2A-D4-05	2A-B4-03	2A-B4-03	2A-D5-05	2A-C5-04	2A-C4-05	2A-E5-03
Date Sampled		08/23/99	09/24/99	09/24/99	09/24/99	09/24/99	09/24/99	10/13/99
Depth (feet below ground surface)		14.8	11.4	11.4	10.2	11.6	24.8	12.0
	Unit							
EPA 6010A								
Antimony	mg/kg	0.62 U	0.43 U	0.27 U	0.39 U	0.28 U	0.27 U	0.57 U
Arsenic	mg/kg	1.7	2.5	2.3	3.9	2.3	2.7	2.4
Вапит	mg/kg	59.5	47.0	49.9	79.2	54.6	37.5	33.8
Cadmium	mg/kg	0.042 U	0.16 U	0.028 U	U 960.0	0.024 U	0.023 U	0.039 U
Chromium	mg/kg	6.8	6.2	5.9	11.9	0.9	5.2	12.9
Cobalt	mg/kg	7.8	7.5	5.9	8,9	6.7	8.00	9.2
Copper	mg/kg	4.5	19.2	11.2	11.4	4.8	2.0 J	2.1
Iron	mg/kg	14500	15200	16000	27600	16000	20800	16900
Lead	mg/kg	4.1	21.6	5.8	8.0	2.6	9'1	2.2
Manganese	mg/kg	190	185	181	218	228	344	260
Molybdenum	mg/kg	0.11 U	0.37 U	0.46 U	0.24 U	0.24 U	0.23 U	0.95
Silver	mg/kg	0.22 U	0.094 U	0.093 U	0.096 U	0.024 U	0.092 U	0.20 U
Thallium	mg/kg	0.38 U	0.36 U	0.36 U	0.37 U	U 160.0	0.35 U	0.35 U
Zinc	mg/kg	18.5	78.1	44.8	66.5	24.2	25.7	000
EPA 7470A/747I						!		3
Mercury	mg/kg .	0.028 U	0.027 U	0.026 U	0.027 U	0.027 U	0.026 11	11 960 0
EPA 8081)	
4,4'-DDD	µg/kg	0.30 U	L1.1	0.29 U	1.7.1	0.29 UJ	0.28 U	0.27 U
4,4'-DDE	μg/kg	0.12 U	1.1 J	0.45 J	3.30	0.12 UJ	0.11 U	0.11 U

EPA - US Environmental Protection Agency

J - estimated value U - not detected at or above the stated reporting limit U - not detected at or above the stated reporting limit a

D - Duplicate sample

mg/kg - milligrams per kilogram NA - not analyzed

µg/kg - micrograms per kilogram

Table E-2

Summary of Final Floor Confirmation Sampling Results

Sample Identification		19739-801D	19739-831	19739-832D	19739-835	19739-837	19739-942
Location Code		2A-E5-03	2A-C3-07	2A-C3-07	2A-C2-07	2A-B2-03	2A-D6-03
Date Sampled		10/13/99	10/21/99	10/21/99	10/21/99	10/21/99	11/15/99
Depth (feet below ground surface)		12.0	17.3	17.3	8.5	5.4	3.5
	Unit						
EPA 6010A							
Antimony	mg/kg	0.57 U	0.59 U	0.58 U	0.57 U	0.57 U	0.58 U
Arsenic	mg/kg	2.5	1.3	0.44	0.45 U	0.85 J	1.4
Barsum	mg/kg	42.1	41.9	33.2	32.4	45.0	37.4
Cadmum	mg/kg	0.039 U	1.5	r 69:0	0.045 U	0.82 U	0.83 U
Chromium	mg/kg	9.81	8.5	4.8	9.8	2.2	4.1
Cobalt	mg/kg	=======================================	9.9	5.8	8.2	5.2	5.8
Copper	mg/kg	2.3	10.1	6.4	4.8	19.5	2.4
Iron	mg/kg	22100	15200	12900	21600	26400	15100
Lead	mg/kg	2.0	10	6.7	2.6	5.6	1.7
Manganese	mg/kg	325	418	338	288	208	119
Molybdenum	mg/kg	0.38 U	0.38 J	0.10 J	0.14 U	1.9	0.83 U
Silver	mg/kg	0.20 U	0.21 U	0.21 U	0.20 U	0.20 U	2.1 U
Thalfium	mg/kg	0.34 U	0.36 U	0.35 U	0.35 U	0.35 U	0.35 U
Zinc	mg/kg	28	730	368	33.9	35.0	23.3
EPA 7470A/7471		•					
Mercury	mg/kg	O 960'O	0.038 J	0.026 J	0.026 U	0.026 U	0.082 J
EPA 8081							
4,4'-DDD	µg/kg	0.27 U	2.0 л	2.2	0.28 U	0.37 J	0.84 J
4,4'-DDE	μg/kg	0.11 U	2.55	3.13	0.11 U	0.27 J	0.20 J

EPA - US Environmental Protection Agency

J - estimated value

U - not detected at or above the stated reporting limit U - not detected at or above the stated reporting limit a

D - Duplicate sample mg/kg - milligrams per kilogram NA - not analyzed

µg/kg - micrograms per kilogram

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CHAIN-OF-CUSTODY RECORD

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Sample Type υ Ü 1 546 2A 1101 @ 3 51 54 2A 1100 @ 7 7) 54 2A 109 @ 7 1) steld 1048 @ 24 15te 24 1102@15 Sample Point Location 13/624 1102@3 10) Syrce (1) 34e2A FORM 0019 REV. 2-97 APCPa h * Sec Metals List MAIL REPORT (COMPANY NAMS) Distribution: White - Laboratory (To be returned with Analytical Report); Goldenrod - Project File; Yellow - Project Data Manager COOLER TEMPERATURE UPON RECEIP CITY, STATE, AND ZIPCODE RECEMENT NAME <u>्</u>वम ADDRESS Hal (기 위 LABORATORY CONTACT LABORATORY FAX CITY, STATE AND ZIPCODE CABORATORY SERVICED LABORATORY ADDRESS 7 7 7 > 7 7 7 7 7 7 1 रहें 3 (949) 474-8309 Sport de (194) 475-5433 19491474-6309 THO TO W -(4 SUDIO B OHM Remediation
Services Corp.
Subsidiary of OHM Corporation
U.S. Route 224 East • Findiary, Ohio 45840 • (419) 423-3526 COPH DEII ١ 11100 COURTER AND AIR BILL NUMBER ĺ TRVINE G 92612 MORETHAMBERS (749261-6441 1037 1054 100 150 324H 16.24 125 77 103 1947 991/261.6441 STRO (544 261-6941 PROJECT LOCATION AND LOP AND LOP AND LOP AND LONG IN MAJORER LAB COORDENATOR'S PHONE tulet, CITY, STATE AND ZIPCODE ر ق MARC Š 10 19739 - 116A Sample Identifier NORTH TShide ROBET MICHELS ON Dr. JURYAG IShida 97 29.124 54-98-123 941-PCFP 1973-122 061-18-691 19339-121 19-39-117 19739-119 19739-110 MaxPen POTECT NAME OF PARTIES OF PROPERTY OF THE PROP SAMPLES COLLECTED BY: OHM's LAB COORDINATOR

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Sample Type: G - Grab, C - Composite, F - Field Sample, QC - Quality Control Sample

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Sample Type: G - Grab, C - Composite, F - Field Sample, QC - Quality Control Sample PROJECT DATA MANAGER'S COPY 219419 FORM 0019 REV. *ないともなっていま Comments MAN, REPORT (COMPANY NAME) Distribution: White - Laboratory (To be returned with Analytical Report); Goldenrod - Project File; Yellow - Project Data Manager COOLER TEMPERATURE UPON RECEIP CITY, STATE, AND ZIPCODE RECIPIENT NAME ADDRESS Rnscata 456 (FIGH C MH 4 LABORATORY CONTACT LABORATORY PAX CHAIN-OF-CUSTODY RECORD 3/29/19 GAZZZE CITY. STATE AND ZIPCODS LABORATORY ADDRESS LABORATORY PHONE SOSTRUK 7 7 1 7 7 ₹. (Spay Spar John (949) 474-8309 (949) 475-5433 949) 474-8309 ino to # ہم ۲ SWDIN \mathcal{C}_{ℓ} Subsidiary of OHM Corporation U.S. Route 224 East • Findiay, Ohio 45840 • (419) 423-3526 1420 HWS COURIER AND AIR BILL NUMBER 不必 33.7 <u>\$</u> 77 <u>ਜੂ</u> 139 1331 394M 1158 TAVINE A 92612 CONSCI LOCATION ALLESA 949) 241-6441 PROJECT MANAGER'S PHONE (949) 24 | -644 (949/261-644 OHM Remediation Services Corp. LAB COORDINATOR'S PHONE tuen <u>ऽ</u> 3 ر 8 رب. محم Sample Identifier 19739 132 दरा ५८ म्हा <u>97 - 126</u> 9739 130 FC1-86-EB1 9739.129 19739 131 Dadgine ISh, dr 351-88 t.b Jungar Ish b 3347 Michaelson SAMPLES COLLECTED BW-Syle 2A MBCT CONTACT

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8 Sample Type Do Not Submit to Laboratory Ľ Project Information Section For Project Personnel Only \mathbf{c} Ö loff es Dup 1097@12 1097@12 1091@15 1091@13 51624 1095016 Sample Point Location Site 2A Rasat

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	Project Information Section	For Project Personnel Only Do Not Submit to Laboratory				Sample Type	Sample Point Location G C F QC	1)Shead 1100@ 11/2	1107 @ 15 115/116	10763%	2.0	7) 3, 1,50 (h /	Sirean	2						Comments			Sample Type: G - Grab, C - Composite, F - Field Sample, QC - Quality Control Sample	
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1	Services Corp. Subsidiary of OHM Corporation Subsidiary of OHM Corporation U.S. Rouer 224 East • Findlay, Ohio 45840 • (419) 423-3526	(449) 475-5433	Comp Dendleton	I-Ch. de (949) 261-641 (949) 474-8309	Chelson arrange a 926 Culture	1904 261-144 (949) 474-8305	Identifier AND CONT. Little AND CONT. AND	Sol 3/20/2 0820 - 3	CC1 - 10 + 11		3 19739-137	7 200		19739 - 139	6 19739-140 10650 - 13	1 063 - 141 063 - 1 1 3 1	8 19 39 1 3	1 + 1 - mbo 1 2 - 1 - 67 = 6	Ţ [,	BY THE COURTER AND ARRITHMUNGER	X (DATE	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Distribution: White - Laboratory (To be returned with Analytical Report); Goldenrod - Project File; Yellow - Project Data Manager	

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WANTINGOD, A ELENE, Ba chen, Coloning, Cherry Cobalt, Copper, Non Load, Marsanese, Mercil Batinony, Acconic, copper, J'con, lead, FORM 0019 REV. 2-97 05660020-58M PROJECT DATA MANAGER'S COPY 218490 Comments Distribution: White - Laboratory (To be returned with Analytical Report); Goldenrod - Project Fille; Yellow - Project Data Manager COOLER TEMPERATURE UPON RECEIPT CITY, STATE, AND ZIPCODE RECEPTENT NAME Do got Holy ADDRESS A POP LABORATORY CONTACT (Age of the state LABORATORY FAX CHAIN-OF-CUSTODY RECORD 99 46 3 9 CITY. STATE AND ZIPCODE LABORATORY ADDRESS 7 > SSS KRIIK 7 > 7×2 Spar Od 6088.764 (676) 1949 474-8309 (949) 474 - 8309 10000 O 0 SW DIV LAB COORDINATOR'S FAX Subsidiary of OHM Corporation U.S. Route 224 East • Findiay, Ohio 45840 • (419) 423-3526 PROJECT PAX Ş COURTES AND AIR BILL NUMBER Peydleton 1/69 a:50 11:20 (5.4%) 12:05 2 :0a 11:35 12:50 5.30 12:35 Truine CA 9761 2 (4 mp pendle 1949) 261-6441 1749-192 (646) PROJECT MANAGER'S PHONE (949) 261-6441 tuen, LAB COORDINATOR'S PHONE OHM Remediation PROJECT LOCATION 3 Services Corp. 6100 0019 473 -314 Sample Identifier DWAYAK Z SALJA 508-18661 3347 Aichelson Da 440 1973 - 309 Dwayne Isaida 173 13 105 - K[P] 1973 - 307 19731 310 805-18161 19731-311 00 00 SAMPLES COLLECTED BY: HRY's LAB COORDINATOR MAX Pan PROJECT CONTACT Item 2 9

8 Sample Type Do Not Submit to Laboratory ĭŢ Project Information Section For Project Personnel Only Ç Ö 10) 20' out (10" 109) 8) 10' aut from 1097 10 out Sion 1097 \$10 m 104 Aro. 2 hand one or of T' 7) 30, out tonian at 1.5' deep S 20, 007 from 109 4150,001 tran 164 Sample Point Location 157 22 3) 10' 60 7 <u>ح</u> 6

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CHAIN-OF-CUSTODY RECORD

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Sample Type: G - Grab, C - Composite, F - Field Sample, QC - Quality Control Sample Arsenic , Copper, 10 Chronium, Color, Copper, 1001, 1000, Silver, thallian 270c. FORM 0019 REV. 2-97 APK' Pg 30f 4 Comments MAJE REPORT (COMPANY NAME) Distribution: White - Laboratory (To be returned with Analytical Report); Goldenrod - Project File; Yellow - Project Data Manager COOLER TEMPERATURE UPON RECEIPT CITY, STATE, AND ZIPCODE J Antinon RECOMENT NAME 4/21/2 ADDRESS adde ス $\overline{\times}$ LABORATORY FAX 2 99 4892 CITY, STATE AND ZIPCODE LABORATORY ADDRESS × × × LABORATORY PHONE SSSTRUK X × 7-20-79 16:32 × × × × N. 608. 461, (64.6) Way of Del 6088-114-6761 6058- 264 (977) J * O CON Ò Q ل O 5 W D:U PROJECT MANAGER'S FAX LAB CODRIDINATOR'S FAX <u>\</u> Penlleton CLIENT COUNTRIX AND ARR BILL NUMBER 15.35 15:22 15.18 Truing Ch 92617 12.10 12:20 21.45 かれ > = (9'9) 261 - 6441 1443 192 (446) (444) 261-644) Net. 99 7-20-PROJECT LOCATION turen, LAB COORDINATOR'S PHONE 3 S 19739-362 1923- 364 CIE 9737-365 132-6561 9-13-15-6 Sample Identifier 896.68661 19739-367 3347 Dichelson Dr 19739-360 19737-361 Dwayne Tsaide Purante Isaida P9.5 105 DHM's LAB COORDINATOR * D · O. mən 10 4 3 9 **r~ ∞** 6

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CHAIN-OF-CUSTODY RECORD

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8 Sample Type Ľ C to 3) is Site 2A Ö × Sample Point Location 2) ZAF6-02

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CHAIN-OF-CUSTODY RECORD

Sample Type: G - Grab, C - Composite, F - Field Sample, QC - Quality Control Sample FORM 0019 REV. 2-97 PROJECT DATA MANAGER'S COPY 221743 APCL Pg40FS Comments MAIL REPORT (COMPANY NAME) Distribution: White - Laboratory (To be returned with Analytical Report); Goldenrod - Project File; Yellow - Project Data Manager COOLER TEMPERATURE UPON RECEIPT CITY. STATE, AND ZIPCODE SAMPLE'S CONDITION UPON RECEIP RECEMENT NAME 9015-66 015-66 ADDRESS TOWN TOOK THE PARTY OF 文 文 X LABORATORY CONTACT LABORATORY FAX 99-4956 CITY, STATE AND ZIPCODE LABORATORY ADDRESS LABORATORY PHONE X Χ̈́ × × × × X SS-KRIIK × γ. × × X Vi d hous 1949 474 -8309 Sport Od 6088-14-6 (46) 6053-464 (646) W OF CON! J U bv 0 S O S W D, J LAB COORDINATOR'S FAX Subsidiary of OHM Corporation U.S. Route 224 East • Findlay, Ohio 45840 • (419) 423-3526 PROJECT FAX 100 COURTER AND AIR BILL NUMBER CLENT CTT.STATE AND ZECODES

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OHM Remediation Services Corp.

CHAIN-OF-CUSTODY RECORD

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(949)261-4441 Cano Pendleton 1949) 261-6441 1449-132 (446) turen) LAB COORDINATOR'S PHONE S 5-89 Re19 19239- 435 4000 53.0 19739- 438 9739-432 19739-437 19739-433 19739 - 431 19739- 436 19739- 430 19739- 429 Sample Identifier DWAYNE ISA; DA DWAYNE I Saida 3347 Aichelson Dr. Pan 0.0. 105 HRY's LAB COORDINATOR SAMPLES COLLECTED BY: ROBCT MANAGER Max

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2 Sample Type Do Not Submit to Laboratory Project Information Section For Project Personnel Only C Ö 6) 7ADS -ol Duplicate 5/2A 05-01 aT6" 8) 2A D4-01 ++6" 1) 2A D4-029+2' 2 A D S - 02 a T 2' 10) 2A BS-01 - +6" Sample Point Location 41 24 ES-02 3) 2A ES-01 <u> - 07</u> 1) 2A D2 : 0

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CHAIN-OF-CUSTODY RECORD

PROJECT DATA MANAGER'S COPY 221757

Sample Type: G · Grab, C · Composite, F · Field Sample, QC · Quality Control Sample FORM 0019 REV. 2-97 P32 of 20 Comments MAIL REPORT (COMPANY NAME Distribution: White - Laboratory (To be returned with Analytical Report); Goldenrod - Project File; Yellow - Project Data Manager COOLER TEMPERATURE UPON RECEIPT CETY, STATE, AND ZIPCODE RECIPIENT NAME 2925- 662 ADSPRESS 191-5262 Con The State of t **×** 人 × LABORATORY CONTACT LABORATORY PAX LABORATORY SERVICE ID CITY, STATE AND ZIPCODE LABORATORY ADDRESS X × × × × \times ۰ × LABORATORY PHONE × SSS TRUE × 7 ~ × 7. X 6088-424(646) 4 eurs 6068-666(666) ' Project 6088-464 (346) ř PROJECT NUMBER · 100 10 # J J O S. W. O.V J S 0 O PROJECT MANAOGR'S FAX \mathbf{C} PROJECT FAX COURTER AND AIR BILL NUMBER CLENT 5 14:23 14:30 4:33 14:55 14.57 15:01 $\frac{8}{8}$ 5:3 14:3 INVINC CA 42617 PROJECT WANAGER'S PHONE (7 4/7) 761 - 6 441 (9 49) 761-6441 MOJECT LOCATION 1777-192 (5/16) S. C. ار^د ا turen. LAB COORDINATOR'S PHONE PROJECT PHONE NUMBER CITY. STATE AND ZIPCODE W ⋛ 19739-445 6,69 19739 - 448 19-29-444 19739-446 19739-447 19739- 443 19739- 442 Sample Identifier 19739- 440 4739-44 ş Dwayne Isaida 3347 Michelson Dr DWAYAC JSAL 19739-105 Par SAMPLES COLLECTED BY: ORM's LAB COORDINATOR ROJECT CONTACT PROJECT ADDRESS PROJECT MANAGE 707

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Chain of Custody
Please Print in pen Page 2 of 3

Page 2 of 3	949-475-5433	92617		White - With report	Yellow - Lab copy	Pink - Originator	c	remarks		How Level IV		Hew		Koch	and the second s	Hold		A.O.H	VI Bral	Hold		Hous	Korher EPA Loure Lephally	days after samples are received	Room Cold (C	Date Time 1-12-991/60	Date/Time
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Washington Document No. 570306 mos. Disposal 22 Record No. [1.47] 1 ... いころう Archive Date: Date: Time: Date: Time: Time: ALLE RICEALE 2 111717 Condition on Receipt Disposal by Lab 🛂 15037 1111 Report to: 10 TAX Project Specific (specify): € 124 MELYPIDENUM, SILVING PHONEUR MASSE MICHERAL UCK1.4.4.4(10) 8 Project Contact/Phone 12 proster (2410)/(949)/66-754 LURAL IBERT IND. 日でご ANTIBLENS ABSENCE Requested Testing Sample Disposal Return to Client Program 94-5492 ONE CONTAINER PER LIN Lab Contact 9 FINNE MINITELE Received by ²⁸ 3. Received by (Signature/Affiliation) 2. Received by (Signature/Affiliation) (Signature/Affiliation) CHAIN OF CUSTODY RECOR Carrier/Waybill No. 13 / (1912) 1632 Project Name/No. 1 PENDLETT / 010130 Samples Shipment Date 7 2/21 **P** servative Lab Destination $8 \, {
m APC}$). 1 b QC Level: 27 I.C. II.C. Unknown 16 Container ¹⁷ Sample ¹⁸ 778 Volume 587 Type AF Poison B シン Time: Time: Date: Date: Time: Sample Team Members 2 Jun (1R111 o / 1/11 KF 14 1/6/12 Collected 2412712 561871 3/57/60 5/53/3 1465 1427 J 77 1459 74 142 100 Skin Irritant Project Manager 4 N. 14x (24 N. Description/Type Sample 15 Required Report Date 113/23/92 Special Instructions: 23 16735 Possible Hazard Identification: S 52 Turnaround Time Required: ²⁶ Normal **그** Rush**ੱ** Purchase Order No. 6 7877 Flammable 🛄 ころう (1) - 72 Profit Center No. 3 2 ンドト 7125 12. しこと 11: المدار # 7 4 7 4 1. Relinquished by 28 (Signature/Affiliation) the Count 3. Relinquished by (Sgruture/Affiliation) 2. Relinquished by (Signaure/Affikaton) プログ ヤバ 515 Sample 14 Non-hazard 🛄 <u>ز</u>٦ Number 1266 1/6 (.6 1566 561.6 ンをこし 1,500 1771

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*See back of form for special instructions.

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CHAIN OF CUSTODY RECORD* ANALYSIS REQUEST AND Project Name/No. 1/2 NOLETON / 919739 100 PAN 00 Project Manager 4 MAX Sample Team Members 2 JIM Profit Center No. 3 the Cigroup

Reference Document No. 570318

Page 1 of

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*See back of form for special instructions Yellow: Field copy White: To accompany samples [mos.] (Tec) 385 - C134 Disposal ²² Record No. (949)475-Archive_ RESULTA JULIA NEGALR CIRILL 7 Condition on Disposal by Lab 🖳 Receipt Project Contact/Phone 12 DWHYDE (949) 261-6441 TO: 10 FAX なう \$4733 250 797 210 3210 212/47に Bill to:5 THE MESSIVE ROLLEDO WVEL TO 24 METALS 20 PATOR (FDINGERS) BATIMONY, PROJUBLIC FIREDOM, PINC (F) (F) Requested Testing Sample Disposal Return to Client Program ONE CONTAINER PER LINE PESICIOE > まだが Lab Contact 9 FRANK MONTEITH JOD (OPE. 7 0/24/99 Carrier/Waybill No. ¹³ CcuRteR **9** Lab Destination 8 MPCL servative 7 HN02 A 8 Samples Shipment Date 7_ Unknown Date/Time 16 Container 17 Sample 18 QC Level: 27 Volume 803 1602 202 Type Por AG Poison B £ 55 25.5 £52 200 28 0417 ē Skin Irritant 🛄 💘 Ŕ 0.0 5617 HOLL * 102-7 @ 0.5 Description/Type Required Report Date $\frac{11}{2} \frac{q/2q/99}{2}$ Sample 15 Possible Hazard Identification: 24 RINSATE Purchase Order No. 6 48123 RINSAT Turnaround Time Required: 26 24. PA - PT 20 - 20 - 42 24.05.0 Flammable 🔲 24-54-01 Special Instructions: 23 ħ 16739. 712 19739-740 19799- 757 14779178 1979-14 9139-741 Sample 14 Number 251-95101 19759-74 Non-hazard

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ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD (cont.)*

११-७०२२ Reference Document No.³⁰ <u>५७०३/४</u> **ont.)*** Page 2_ of 2/

Project No. 019739

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Project Information Section
For Project Personnel Only
Do Not Submit to Laboratory

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Distribution: White - Laboratory (To be returned with Analytical Report); Goldenrod - Project File; Manilla - Project Data Manager

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APPENDIX F REVIEW COMMENTS



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY REGION IX

75 Hawthorne Street San Francisco, CA 94105

April 3, 2003

Nr. Mike Bilodeau Project Manager Southwest Division Naval Facilities Engineering Command 1220 Pacific Highway, (Code 532 MB) San Diego, CA. 92132-5190

APPROVAL OF REMEDIAL ACTION SITE CLOSURE REPORT, OPERABLE UNIT 3, INSTALLATION RESTORATION SITE 2A 14 AREA GREASE DISPOSAL PIT, MARINE CORP BASE CAMP PENDLETON, CALIFORNIA

Dear Mr. Bilodeau:

The United States Environmental Protection Agency (USEPA) has reviewed the above referenced document and finds our comments have been addressed and we therefore have no further comments.

We wish to thank the Marine Corps for the opportunity to participate in this project and look forward to continued success in the environmental remediation projects at the Camp. If you have questions regarding this letter feel free to contact me at (415) 972-3007.

Sincerely,

Martin Hausladen

Remedial Project Manager

Marton Bene

cc:

Department of Toxic Substances Control Attn: Mr. Tayseer Mahmoud 5796 Corporate Ave. Cypress, CA 90630

California Regional Water Quality Control Board San Diego Region Attn: Ms. Beatrice Griffey 9174 Sky Park Court, Suite 100 San Diego, Ca 92123-4340

Office of the Chief of Staff - Environmental Security Engineering Department Attn: Ms. La Rae Landers P.O. Box 555008, U.S. Marine Corps Base Camp Pendleton, CA 92055-5008



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anvironmental

Protection

California Regional Water Quality Control Board

San Diego Region



Internet Address: http://www.swrcb.ca.gov/rwqcb9/ 9174 Sky Park Court. Suite 100, San Diego. California 92123 Phone (858) 467-2952 • FAX (858) 571-6972

January 17, 2003

Department of the Navy Southwest Division Naval Facilities Engineering Command (SWDIV) Attn: Mr. Michael Bilodeau 1220 Pacific Highway San Diego, California 92132-5190

Dear Mr. Bilodeau: File No. 30-0456.05

SUBJECT: DRAFT REMEDIAL ACTION SITE CLOSURE REPORT, OPERABLE UNIT 3, INSTALLATION RESTORATION SITE 2A, 14 AREA GREASE DISPOSAL PIT, MARINE CORPS BASE, CAMP PENDLETON, CALIFORNIA

The Regional Water Quality Control (San Diego, RWQCB) has reviewed the above referenced document (Report) prepared by IT Corporation, and dated November 8, 2002. The Report presents an overview of site investigation, remedial, and restoration activities conducted at Installation Restoration (IR) Site 2A to eliminate conditions that pose a threat to human health and the environment. Remedial activities at IR Site 2A were conducted July 6, 1999 through November 12, 1999, and restoration and revegetation activities were conducted June 26, 2000 through October 2000.

The Report is a well-written, formatted, and organized document that contains all the pertinent information necessary for review. Based on current site conditions, the consultant concludes and recommends the following:

- Site 2A has been remediated in accordance with the OU 3 ROD,
- Site 2A conditions no longer pose a threat to human health or the environment, and
- long term postclosure operation, monitoring, or maintenance is not required at Site 2A.

Based on the Report, it appears that the consultant's conclusions and recommendation are correct and appropriate. Additionally, based on the quality of the document, the generation and submittal of a draft final version of the Report does not seem to be warranted.

If you have any questions regarding this letter, I may be reached by phone at (858) 467-2728 or by electronic mail at grifb@rb9_swrcb_ca.gov.

California Environmental Protection Agency

January 17, 2003

Sincerely,

Beatrice Griffey, M.Sc., RG

Associate Engineering Geologist Site Mitigation and Cleanup Unit

Beature Crifber

BG;jpa;bg C:\Facilities\Camp Pendleton\CERCLA Prgrm\Various Reports\Closure Reports\Site 1F doc

Cc:

U.S. Environmental Protection Agency, Region 9

Attn: Mr. Martin Hausladen

75 Hawthorne St.

San Francisco, CA 94105-3901

Department of Toxic Substances Control

Attn; Mr. Tayseer Mahmoud

5796 Corporate Ave.

Cypress, CA 90630

Office of the Chief of Staff - Environmental Security

Engineering Department

Attn: Ms. La Rae Landers

P.O. Box 555008, U.S. Marine Corps Base

Camp Pendleton, CA 92055-5008

IT Corporation

Attn: Mr. Max Pan

3347 Michelson Drive, Suite 200

Irvine, CA 92612-1692



Winston H. Hickox Agency Secretary California Environmental Protection Agency

Department of Toxic Substances Control

Gray Davis Governor

Edwin F. Lowry, Director 5796 Corporate Avenue Cypress, California 90630

January 13, 2003

Mr. Mike Bilodeau Southwest Division Naval Facilities Engineering Command 1220 Pacific Highway, (Code 532, MB) San Diego, California 92132-5190

APPROVAL OF DRAFT REMEDIAL ACTION SITE CLOSURE REPORT FOR SITE 2A, FORMER GREASE DISPOSAL PIT, OPERABLE UNIT 3, MARINE CORPS BASE CAMP PENDLETON

Dear Mr. Bilodeau:

The Department of Toxic Substances Control (DTSC) has reviewed the above subject document dated November 2002, prepared by IT Corporation. The report documents the remedial action activities, site backfilling and restoration activities, and confirmation sampling conducted at Installation Restoration (IR) Site 2A, 14 Area Grease Disposal Pit, at Marine Corps Base Camp Pendleton. The volume of burn debris and contaminated soil removed from the site was approximately 29,341 cubic yards and was transported to and disposed of at the Corrective Action Management Unit located at IR Site 7, Box Canyon Landfill.

Based on the results of the confirmation sampling, the remedial action met the remediation standards specified in the Operable Unit 3 Record of Decision. DTSC agrees with the conclusions and recommendation of the report and we hereby approve it. The site is now considered closed and no long term operation, monitoring, or maintenance is needed.

Mr. Mike Bilodeau January 13, 2003 Page 2

We look forward to working with you to expedite the investigation and cleanup of the sites. If you have any questions, please call Mr. Tayseer Mahmoud, Remedial Project Manager, at (714) 484-5419.

Sincerel

John E. Scandura, Chief Office of Military Facilities Southern California Operations

CC:

Ms. Beatrice Griffey
Project Manager
San Diego Regional Water Quality Control Board
9174 Sky Park Court, Suite 100
San Diego, California 92123-4340

Mr. Martin Hausladen Remedial Project Manager U.S. Environmental Protection Agency, Region IX 75 Hawthorne Street San Francisco, California 94105-3901

Ms. La Rae Landers
Office of Chief of Staff - Environmental Security
P.O. Box 555008
U.S. Marine Corps Base
Camp Pendleton, California 92055-5008